INTERAVIA

REVIEW OF WORLD AVIATION

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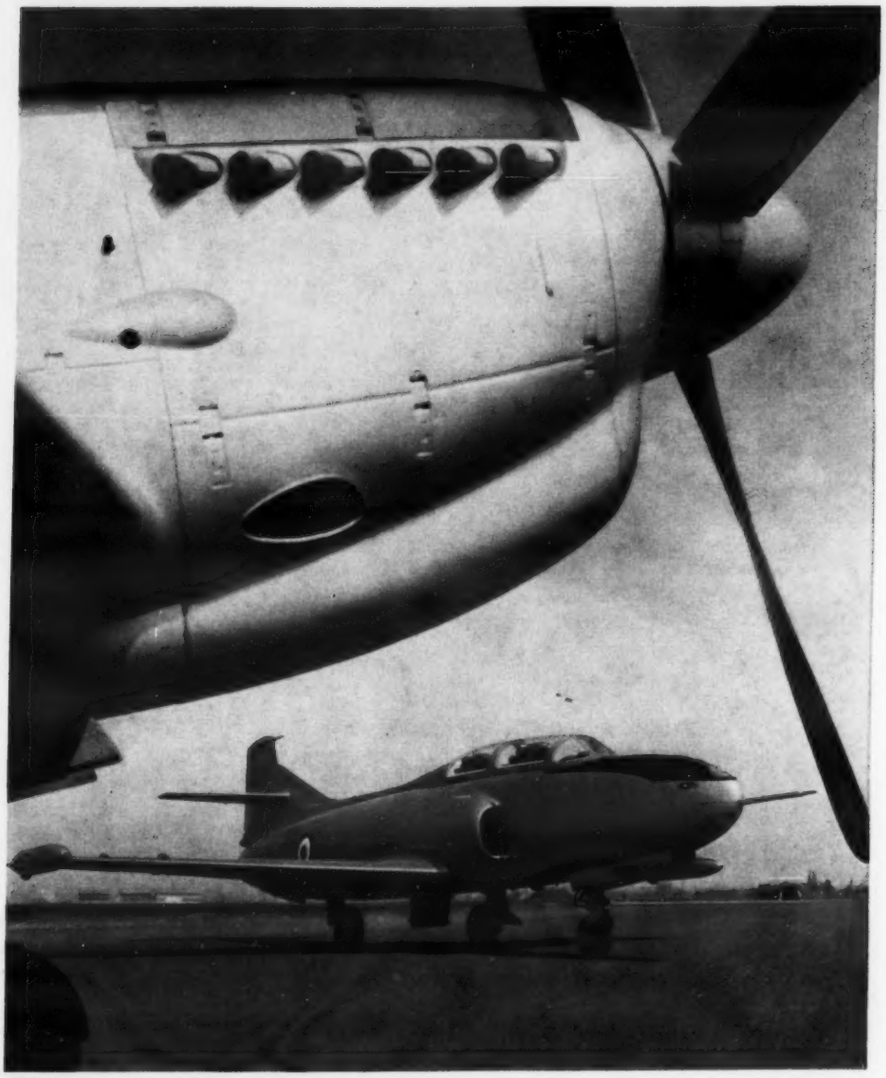
21st Paris Salon

N. A. T. O. Show...

VOLUME X 6 JUNE 1955

FIAT AVIATION



FIAT AIRCRAFT

The series of trainers	FIAT G 46 FIAT G 49 FIAT G 59 FIAT G 80 FIAT G 82
Light tactical support aircraft	FIAT G 91

WITHIN THE FRAMEWORK OF N.A.T.O.

Aircraft:

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FIAT G 91	
FIAT F 86 K	(North American Aviation licence)
FIAT VAMPIRE	(de Havilland licence)
FIAT VENOM	(de Havilland licence)

Jet engines:

FIAT GHOST 48 MK 1	(de Havilland licence)
ALLISON J-35-A-29	(Allison licence—parts)
GENERAL ELECTRIC J-47	(General Electric lic.)

Piston engines:

FIAT RA 1050 (D.B. 605)	(overhaul)
PRATT & WHITNEY R-985	(Pratt & Whitney licence—parts)
PRATT & WHITNEY R-1830	(overhaul)
PRATT & WHITNEY R-2800	(overhaul)
ROLLS-ROYCE MERLIN 500	(overhaul)

Propellers:

FIAT 5006 two-blade	(Hamilton licence)
FIAT 5010 four-blade	(Hamilton licence)

FIAT DIVISIONE AVIAZIONE - CORSO G. AGNELLI, 200 **TURIN** (Italy)

INTERAVIA

Review of World Aviation

Volume X | No. 6 | June 1955

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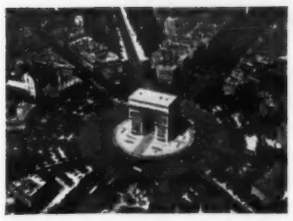

Front Cover

ARC DE TRIOMPHE and ÉTOILE, landmarks of Paris. — Air photo by Pilote-Opérateur R. Henrard.

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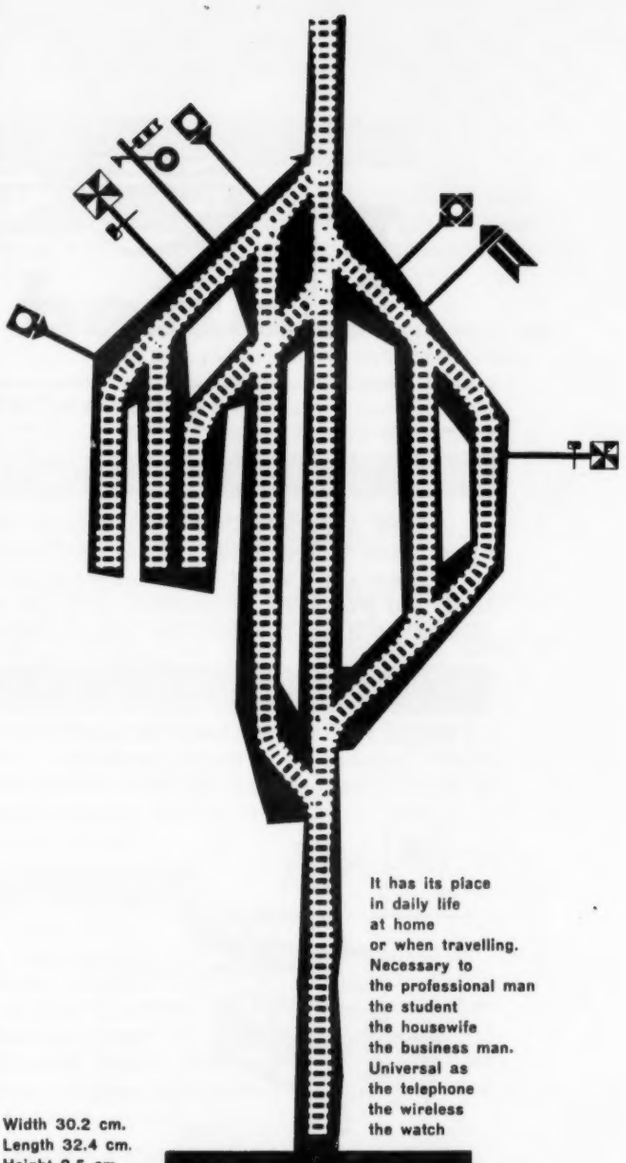


It has its place
in daily life
at home
or when travelling.
Necessary to
the professional man
the student
the housewife
the business man.
Universal as
the telephone
the wireless
the watch

Width 30.2 cm.
Length 32.4 cm.
Height 8.5 cm.
Weight 3.7 Kg.

Ing. C. Olivetti & C., S.p.A. Ivrea (Italie)

Olivetti Lettera 22

United Airgram

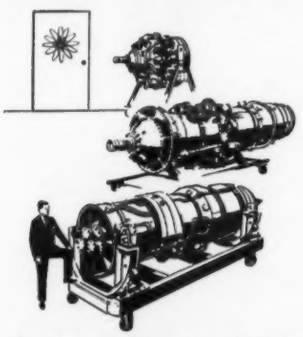
UNITED AIRCRAFT EXPORT CORPORATION

UNITED AIRCRAFT CORPORATION REPORTS HIGH 1954 ACTIVITY

United Aircraft Corporation's divisions made substantial contributions to both commercial and military fields of aviation during 1954, according to the annual report recently issued to stockholders. Production of Pratt & Whitney Aircraft engines, Hamilton Standard propellers and jet engine equipment, and Sikorsky helicopters continued at high levels. The total number of employees was 45,843 as of the year's end.

GAS TURBINE WORK ADVANCED AT PRATT & WHITNEY

While Pratt & Whitney Aircraft's work in 1954 dealt with four categories of aircraft engines -- piston, turbojet, turboprop and a nuclear energy power-plant -- the principal effort was on gas turbine projects. These engines, mostly J-57s, represented more than half of the division's 1954 shipments. Early this year, the 1000th J-57 was delivered.



During the year a new, highly-advanced axial-flow turbojet engine, the J-75, was put on full-scale test. Performance figures on this engine are confidential. Other jet projects are under way. In the turboprop field, work was advanced on the T-57, a propeller-turbine adaptation of the J-57. This engine has been undergoing full-scale testing. It has exhibited outstanding power and excellent economy. The 6000 h.p. T-34 turboprop engine powered Air Force and Navy prototype transports in service test flights during the year.

Work on the atomic-powered engine, begun in 1951 under contracts with the Air Force and the Atomic Energy Commission, has gone forward on schedule.

PARIS AIR SHOW FEATURES J-57 TURBOJET IN EXHIBIT

Two Pratt & Whitney Aircraft J-57 jet engines -- one with afterburner and one without -- will be featured displays in United Aircraft's exhibit June 10 to 19 at the 21st Salon International de l'Aeronautique at Le Bourget Airport, Paris. This will be the first public appearance in Europe of the 10,000-pound thrust class jet. Various models of the engine power seven different American military aircraft types now in quantity production.

United Aircraft's exhibit will also include: two P&WA piston engines, an R-1340 made by Canadian Pratt & Whitney Aircraft, Ltd., and an R-2800; cutaway models of Hamilton Standard's pneumatic jet engine starter and hydraulic pump; a Hamilton Standard synchrophaser; a cutaway 1/10 scale model of Sikorsky Aircraft's big S-58 helicopter. Also shown will be propeller tool and test equipment from Kell-strom Tool Co., Inc., and vibration research equipment and engine mount vibration isolators from The MB Manufacturing Co., Inc. These products are sold in Europe by United Aircraft Export Corporation.

HAMILTON STANDARD CONTINUES PROPELLER LEADERSHIP, DOUBLES EQUIPMENT OUTPUT

Hamilton Standard division's traditional leadership of the propeller field was maintained during 1954 in both military and commercial aviation. More than 90 per cent of all the world's commercial air transports are now equipped with Hamilton Standard propellers.

In addition to its propeller production, Hamilton Standard in 1954 doubled shipment of equipment for jet-powered aircraft. Equipment included gas-turbine fuel controls, aircraft air conditioning units, gas-turbine engine starters and hydraulic pumps. These products were manufactured in many different models. At the year's end, Hamilton Standard units were specified for use on 38 different types of jet-powered aircraft.

Work on large turbine propellers also increased during the year, in both production and experimental fields. Production Turbo-Hydromatics were built for T-34-powered Navy and Air Force transports. New "nose mounted" propellers for very high-power turbine engines were in development.

Large, well-equipped facilities were added for research, development and production.

SIKORSKY DEVELOPS THREE NEW HELICOPTERS; S-55 OUTPUT HIGH

Sikorsky Aircraft introduced three new helicopters in 1954. It began production on two of them in addition to continuing high output of versatile S-55s for airlines, military services and industrial and commercial users around the world. In Europe, a fleet of S-55s carried more than 22,000 passengers in 1954 for Sabena Belgian World Airlines, while four airlines used S-55s for passenger, mail or cargo services in the United States. S-55s were widely flown in mining, construction and oil projects.

First production models of the S-58 type, a new helicopter with about twice the load carrying capacity of the S-55, were delivered to the U. S. Navy in September.

Largest helicopter introduced was the S-56, a twin-engine assault aircraft developed for the U. S. Marine Corps. It will be able to carry 26 fully-armed men. Delivery is scheduled to begin late this year.

Sikorsky's third new helicopter was the four-place S-59, a light machine powered by a small gas turbine. This craft now holds both world speed and altitude records for helicopters.

Construction of new plant facilities at Stratford, Connecticut, was begun during the year. When complete, the new factory will double Sikorsky's present capacity.

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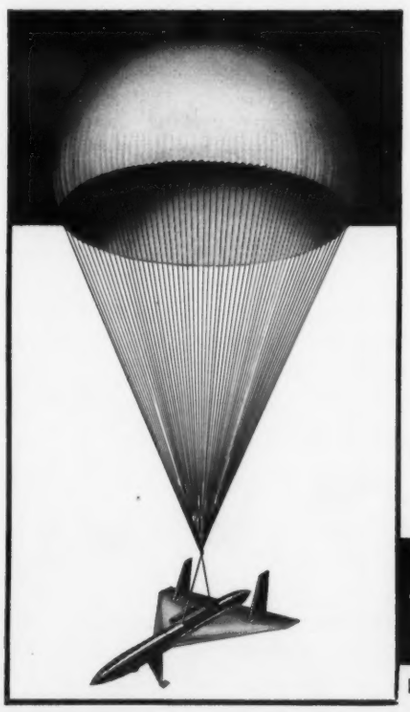
The Use of the DEL MAR DELta Aerial Tow TARGET permits Assessment and Evaluation of MISSILE WEAPONS SYSTEMS!

DEL MAR DELta recovered by PIONEER PARACHUTES



Perfection of America's arsenal of rockets and guided missiles is being accomplished efficiently and economically in the Air Force Missile Development Program.

In this instance the Del Mar DELta high speed, high altitude tow target provides a stable platform to carry Miss-Distance Indicator Systems for missile evaluation programs and is fully recovered from the air by Pioneer parachutes, to be used over and over again.

This is one of the many examples where the Taxpayers' money is used wisely by the Armed Forces. The design and manufacturing facilities of both the Del Mar Engineering Laboratories of Los Angeles, and the Pioneer Parachute Company have combined to serve both the Armed Forces and the nation's economy.

Pioneer engineers are constantly working with engineers of aviation companies, as well as the U.S. Air Forces, developing and manufacturing special parachutes for special uses. We are ready to serve you—our engineering staff is available for consultation wherever you may be located.

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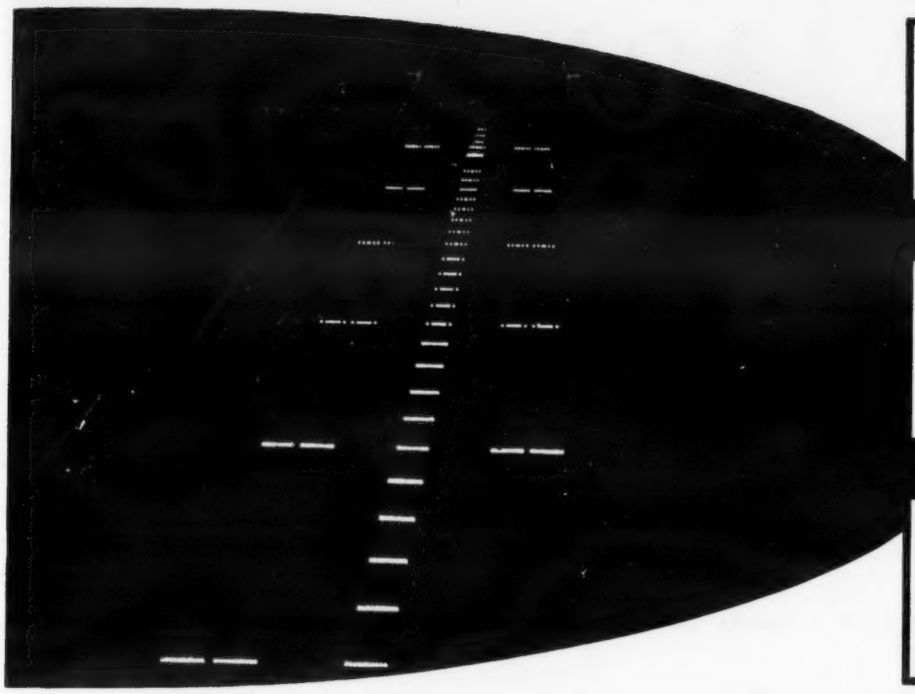

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series transformer

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approach light

Taxiway light

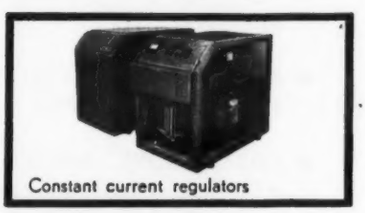
Cleared to land!

Under bad visibility conditions during night or daytime the pilots of aircraft approaching to land must rely on the ground staff of an airport.

Just that extra safety can be obtained if they can also see where they are going.

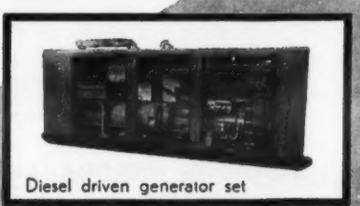
Good and dependable lighting systems are, therefore, one of the essentials of a modern airport, be it civilian or military.

Philips, with their vast experience in the manufacture of all kind of light sources, have thoroughly investigated the problems connected with airport lighting. Philips Airport Lighting Equipment, resulting from this research has been approved by NATO and the American Airforce.



Constant current regulators

High intensity
runway light



Diesel driven generator set

PHILIPS

PHILIPS

for dependable Airport Lighting

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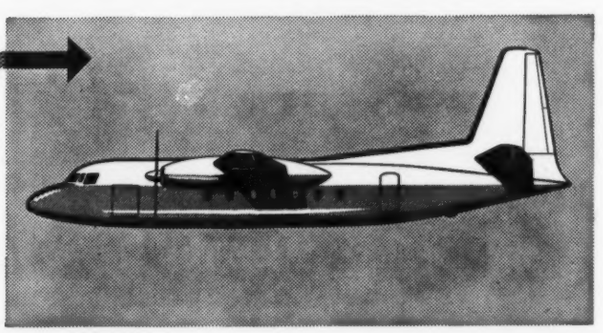

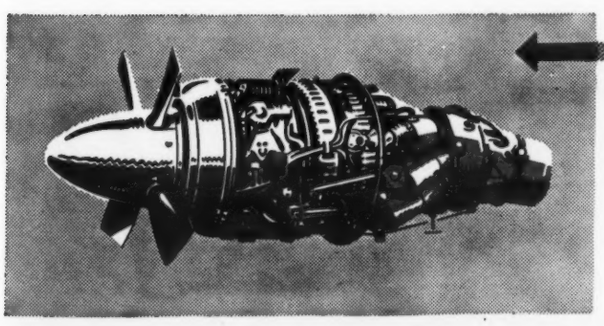

THE ROLLS-ROYCE "DART" TURBOPROPS

with which the "Friendship" is powered are the most reliable propeller-turbines available for this type of aircraft. They allow economical operation in all climates and safe and vibrationless flight at 20,000 ft.

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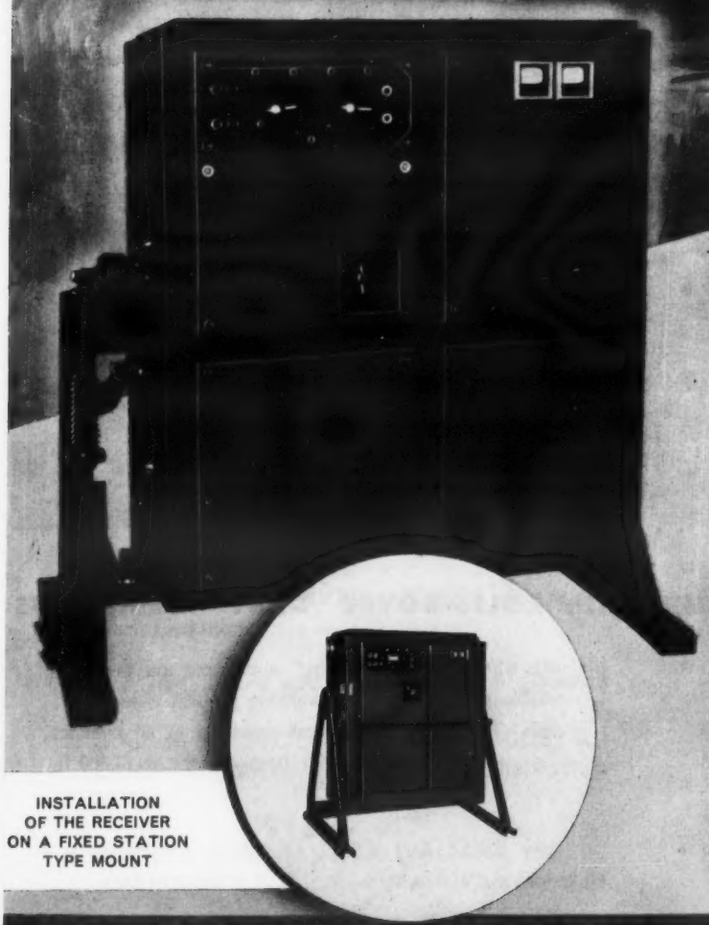

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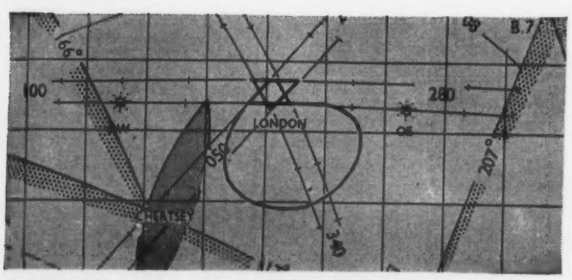

The track of the aircraft as shown on the Flight Log

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A JOURNEY ABOARD AIR FRANCE'S DE LUXE AIRCRAFT

is an incomparable pleasure

YOU, as an expert, an aviation specialist, can judge better than all others the scope of the efforts which Air France has made during the past year to improve the comfort of its passengers. But do you know that you can today cross the Atlantic in the intimacy of a real cabin, furnished with a single or double bed, with bedstead, mattress, sheets, blankets and pillows ? By day this comfortable bed-room is transformed into an elegant sitting room with deep comfortable arm-chairs.

Passengers on these aircraft can make use of two small drawing rooms, decorated in fine woods, where they can relax or play bridge.

At meal-times the atmosphere becomes that of a great Parisian restaurant. The exquisite menus, always accompanied by fine wines and vintage champagne, are celebrated throughout the world.

The skill of its pilots, the composition of its fleet and the extent of its network are Air France's best arguments. They have made its luxury aircraft France's able ambassadors to all parts of the world.

AIR FRANCE

ALL TRAVEL AGENCIES AND AIR FRANCE OFFICES

YVAL P. 802

Succès d'hier
qui se confirme...

FORTY "NORÉCRIN" FOR SWITZERLAND

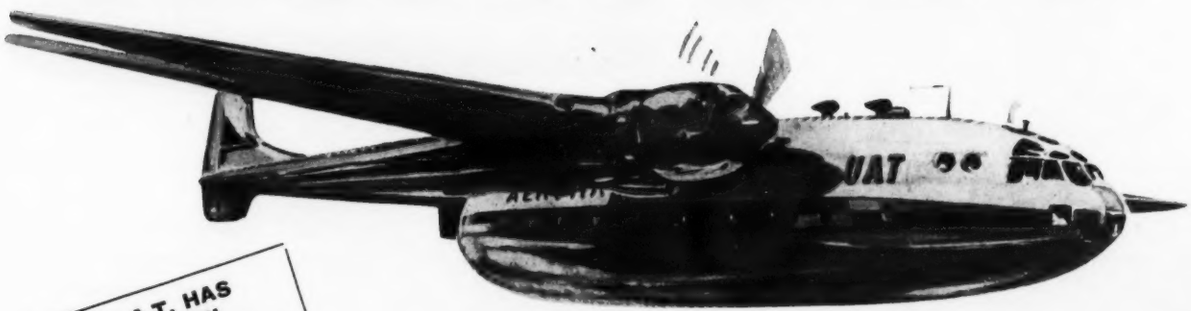
A large Zurich firm, whose activities cover flying training and charter operations, has just placed an order for ... « Norécrins » wi... Nationale de ... Aéronaut

Même origine...

NORÉCRIN

...même succès

NORATLAS



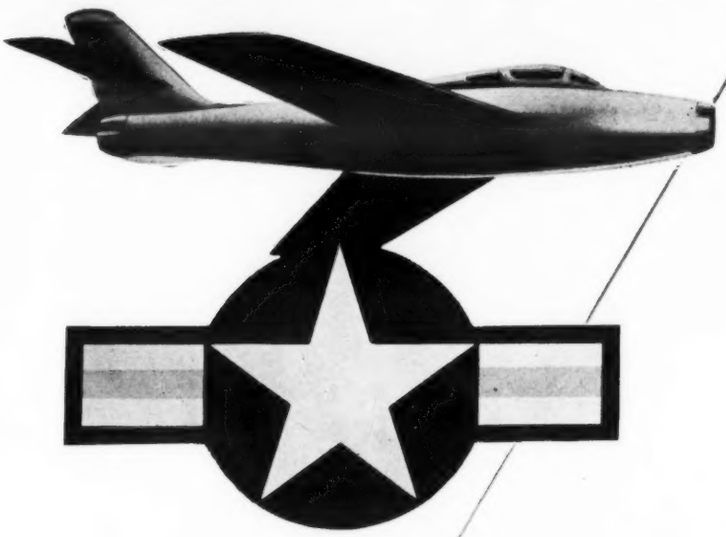
U.A.T. HAS CHOSEN "NORATLAS"

After a successful trial period, the well-known French airline U.A.T. has ordered a number of Nord 2501s from S.N.C.A.N. for its African services.

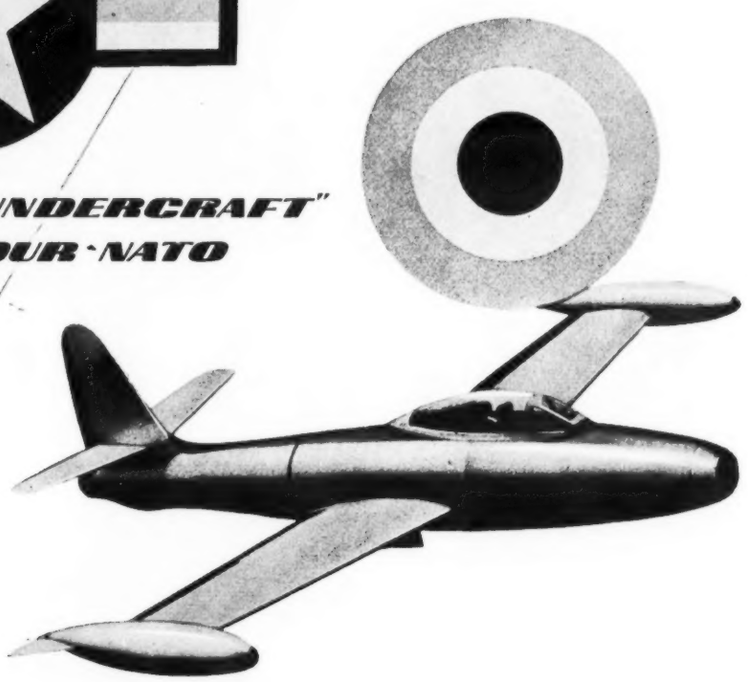
Succès d'aujourd'hui
qui s'affirmera...

S.N.C.A.N. 12, Rue Béranger, Châtillon s/Bagneux (Seine) ALE 57-40

DE PLUS EN PLUS...



D'AVIONS "THUNDERCRAFT" VOLENT POUR NATO



Depuis plus de quatre ans, le Thunderjet Republic F-84 a été basé dans 12 pays de l'Europe comme chasseur-bombardier de première ligne au service de la paix. ➤➤➤ Maintenant... son compagnon à aile en flèche... le Thunderstreak F-84-K... entre en service dans les unités de l'U.S.A.F. et dans les armées de l'Air française et alliées pour fournir un appui plus puissant, plus rapide et à plus grand rayon d'action à la cause de NATO. ➤➤➤ Voyez donc l'exposition de Republic au XXIe Salon International, à Paris, du 10-19 juin 1955.

REPUBLIC AVIATION

FARMINGDALE, NEW YORK, U.S.A.

Créateurs et Constructeurs de l'Incomparable **"THUNDERCRAFT"**

INTERAVIA

Deadline Notes

No. 6, 1955

MILITARY CLAUSES OF PEACE TREATIES

N.A.T.O. members who were signatories to the Italian Peace Treaty have informed the Italian Government that all restrictive clauses of the Treaty affecting the military and industrial domains have been annulled. Italy may now build and use bombers, rockets and special weapons, construct bases along the frontier and produce and export any kind of aviation equipment. There are no further legal barriers to the expansion of her armed services. - On the other hand the Austrian State Treaty signed on May 15th forbids heavy weapons (atomic weapons, guided missiles, chemical and biological weapons etc.). - As regards West Germany it will be recalled that in the Paris Agreements it was agreed to prohibit production of the so-called ABC weapons (atomic, bacteriological and chemical weapons), long-range bombers, rockets and heavy-tonnage warships.

BRITISH CIVIL AIR ATTACHE FOR BONN

The British Ministry of Transport and Civil Aviation has appointed former Director of the U.K. High Commission's Civil Aviation Division Johnson as Civil Air Attaché to the British Embassy in Bonn.

SWEDISH GUIDED WEAPONS

A first instalment of 10,000,000 Kronor out of the 25,000,000 Kronor earmarked in 1954 for development and production of an anti-aircraft guided missile by the Swedish Air Force has now been awarded. It is reported from a reliable source that this missile (designation Luftförsvarsrobot = air defence robot) has a range of at least 120 to 150 miles. The official announcement merely states that it is an "unmanned fighter" (said to have a certain resemblance to the Boeing IM-99 Bomarc).

K.L.M. TO BE LISTED ON STOCK EXCHANGE?

Associated Press reports that M. J. van der Ploeg, Deputy President in charge of Finance, has told a press conference that K.L.M., which is 95% Government-owned, is considering applying for permission to list its ordinary shares on several foreign stock exchanges, including New York.

SPECIAL FARES FOR CAMPERS

Air France is granting all campers a reduction of 35% on the price of tickets for any of the France-North Africa routes.

B.E.A.'S FIRST PROFIT

For the first time in its eight years history British European Airways announces a net profit for the business year ending on March 31st, 1955. In his statement Lord Douglas of Kirtleside announces that after deducting £654,000 for interest payments and £1,500,000 for depreciation a net profit of £50,000 was left.

INTERNATIONAL FEDERATION OF PRIVATE AIR CARRIERS

Private airlines, already organized in the Fédération Internationale des Transporteurs Aériens Privés (F.I.T.A.P.), plan to set up a European association to represent their interests at the second Strasbourg Conference on the Coordination of European Air Transport (opening on November 29th, 1955).

$ 250,000,000 FOR U.S. AIRPORTS

Senator M. Monroney, Chairman of the Senate Interstate Commerce Committee's aviation sub-committee, has introduced an amendment to the Federal Airport Act to authorize the Secretary of Commerce to give the States $ 60,000,000 annually and Alaska, Hawaii, Puerto Rico and the Virgin Islands $ 3,000,000 a year for the next four years.

* From INTERAVIA's world-wide news service, including INTERAVIA AIR LETTER, the daily international aviation news digest. — No part may be reproduced without written permission.

P.A.A.'s ARCTIC PLANS

Pan American World Airways have applied to the Civil Aeronautics Board for permission to operate an Arctic service from the U.S. west coast to Europe. American terminals planned are Los Angeles, San Francisco, Portland and Seattle, with London and a number of Continental European cities as destinations.

HENSCHEL BECOMES SIKORSKY REPRESENTATIVE

It is reported from Germany that Henschel & Sohn G.m.b.H., of Kassel, has concluded an agreement with United Aircraft Corporation, Hartford, Conn., for the sale, assembly and maintenance of Sikorsky helicopters in West Germany.

A.I.C.M.A. ANNUAL MEETING

The Association Internationale des Constructeurs de Matériel Aéronautique held its General Meeting at the headquarters of the Italian aircraft industry association, Palazzo Venezia, Rome, on May 20th and 21st, 1955. The Meeting was attended by representatives of the aircraft industries of Italy, France, Spain, Holland, Belgium, Sweden and Switzerland. Delegates from the embryo German aircraft industry also took part for the first time, but Denmark's and Norway's representatives sent their excuses. The Meeting was presided over by A.I.C.M.A. Chairman General Alfredo Bruno (also Chairman of the Italian Aircraft Industry Association). Member countries of A.I.C.M.A. now number ten, but Honorary President Georges Héreil (S.N.C.A. du Sud-Est) states that others will be welcome to join.

TRANS-CANADA AIR LINES' VISCOUNT RESULTS

In March, prior to the introduction of the Viscounts, T.C.A. carried 6,163 passengers at a load factor averaging 75.5% per flight, and T.C.A.'s share of the total passengers flying on the Toronto-New York service was 42%. In April, the company carried 9,682 passengers; load factor 90.4%; T.C.A.'s share of the total traffic 54%. Viscounts were put on the New York-Toronto run on April 4th scheduling five trips daily return. T.C.A.'s seat capacity on the route increased in April by 31%, and the number of passengers actually carried by 57%.

WORKSHOP BRIEFS ...

Rem-Cru Titanium Inc., of Midland, Pa., announces new price reductions for titanium: sheet is now down to $ 13 a pound, bars and billets to $ 8.50 a pound, and weldable high-strength A-110 alloy is reduced by 13%. * The LM-1 four-to-six-seat single-engined low-wing touring and communications aircraft (225 h.p. Continental C-470-13) is in final assembly at Fuji Heavy Industries Co. * Avia LD-40 Meta-Sokol is a development of the well-known Sokol touring aircraft; Walter Minor 4-III 105 h.p. engine. * The French firm of SIPA is fitting a two-seat C.A.B. Supercab with 5.5-gallon wing-tip tanks; range with these tanks is about 620 miles at 140 m.p.h. * Pilots Maner Lualdi and V. Sanseverino have reached a speed of 635 m.p.h. in level flight in the Fiat G.82 jet trainer at an altitude of 19,680 ft. * Hispano Aviacion's HA-100 F-1 two-seat trainer (800 h.p. Wright Cyclone 7) has begun flight testing. * Republic Aviation has received a "substantial" order from the U.S. Air Force for the RF-105 photographic reconnaissance aircraft, a special version of the Republic F-105A fighter-bomber (Allison J-71-A-7 of 9,700/14,000 lbs static thrust). * The SR 7 two-seat trainer of Constructions Aéronautiques Stampe & Renard S.A., Evere-Brussels, is fitted with a 180 h.p. Blackburn Bombardier (or 170 h.p. SNECMA if required); gross weight 2,090 lbs. with fuel for four hours; max. speed 150 m.p.h.; rate of climb 985+ ft/min.; take-off distance to clear 50-ft obstruction 260 yards. * The U.S. Navy has awarded a production contract for the Goodyear ZS2G-1 twin-engined airship. * Martin B-57E is the designation of a special version of the Martin Canberra for use as target tug. * Lockheed TF-104, two-seat trainer version of the F-104A supersonic fighter, will have seats in tandem and ejectable downwards. * Further Turboméca products for Paris: Artouste III, shaft engine with three-stage turbine; take-off power 590 h.p. - Palouste IV, turbo air compressor for 2.5 lbs./sec. max. air flow. - Autan, turbo air compressor for 2.97 lbs./sec. max. air flow. - Arbizon, turbojet of 550 lbs. static thrust.

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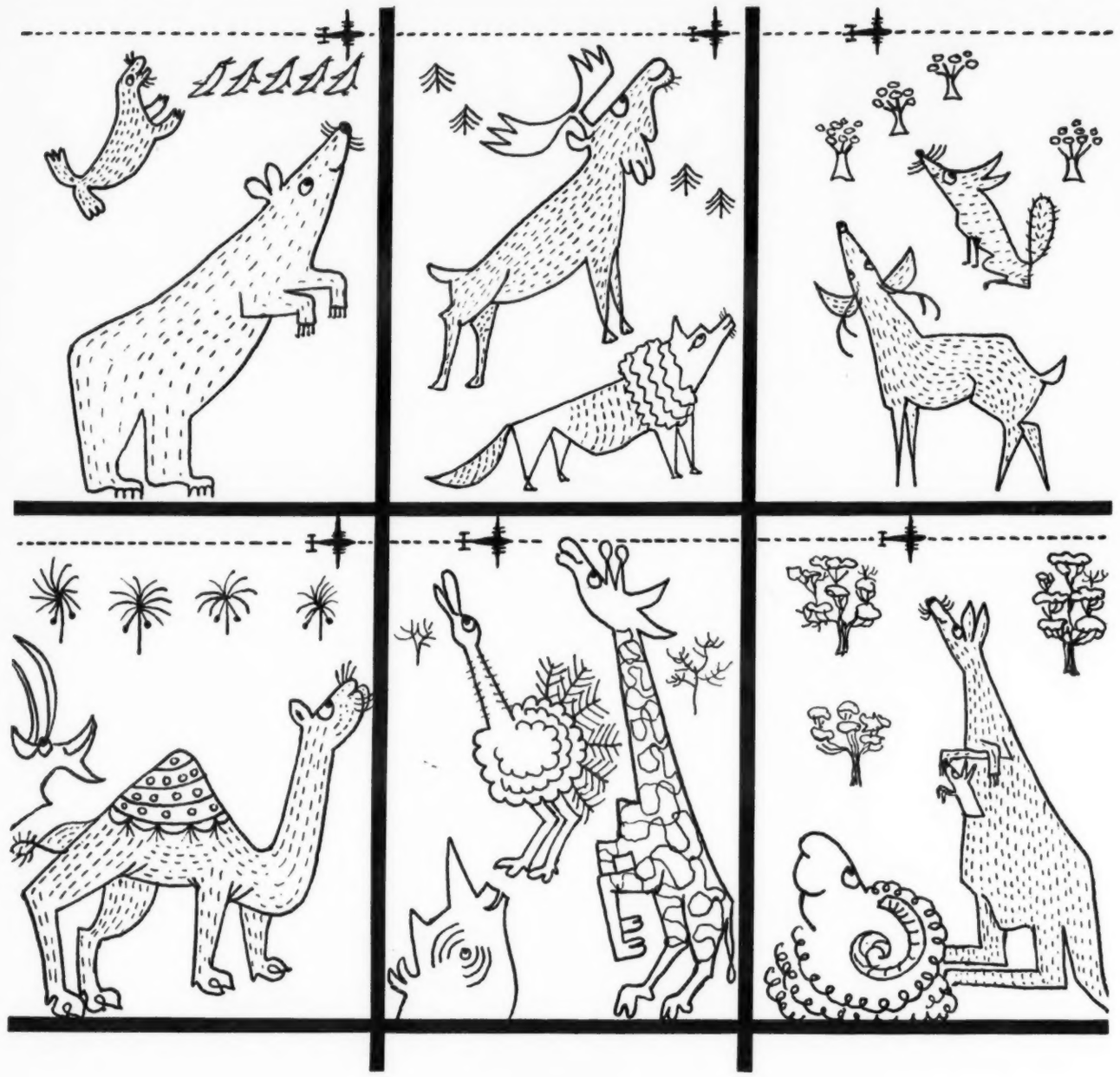
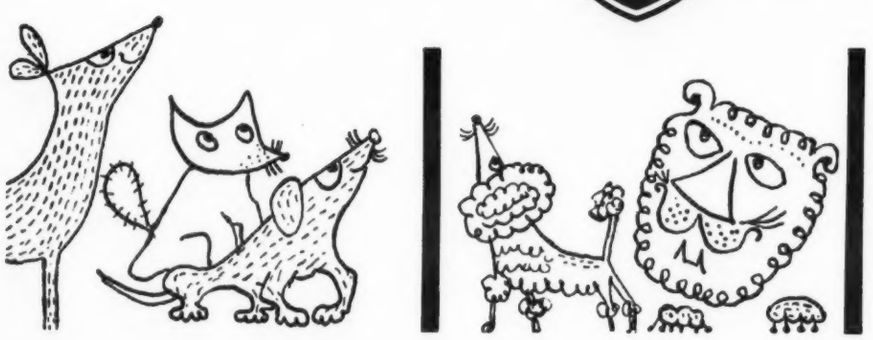
DIE DEUTSCHE WELTMARKE



AVIATION BP SERVICE



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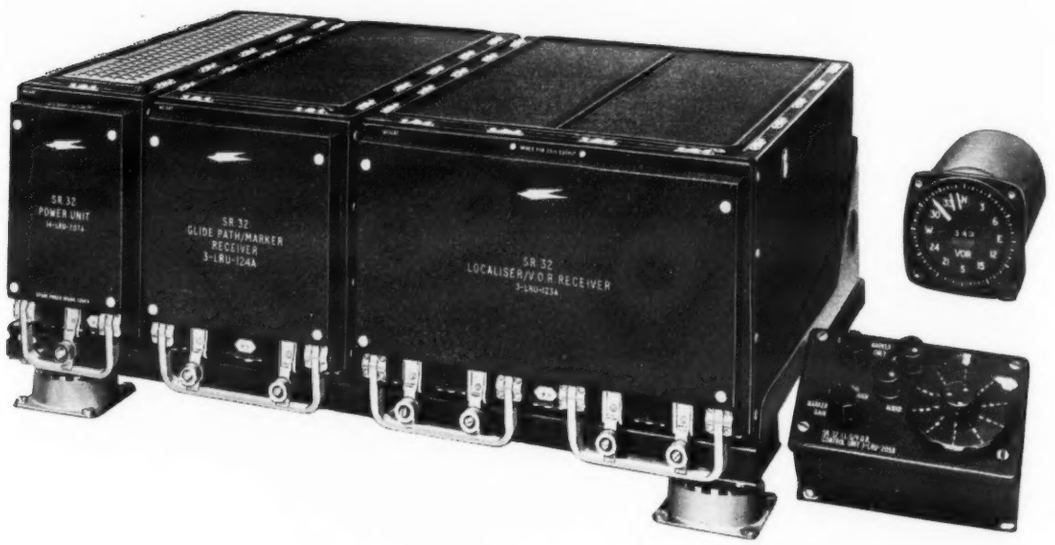

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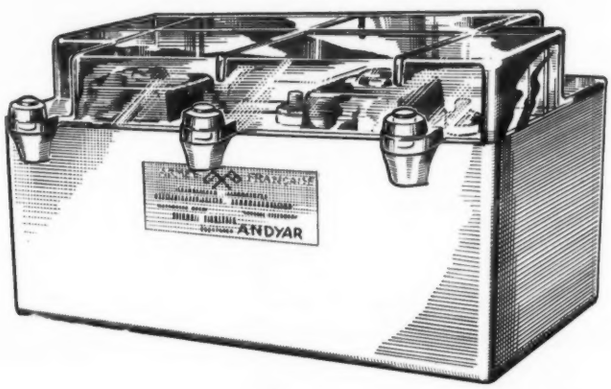

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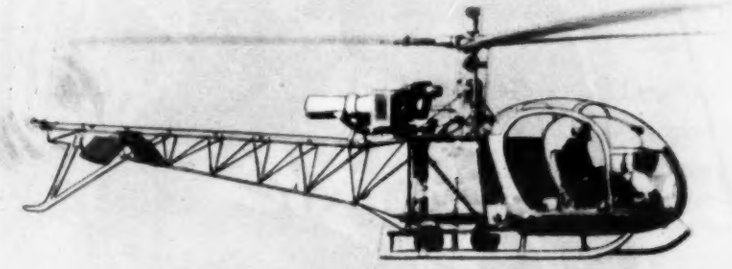

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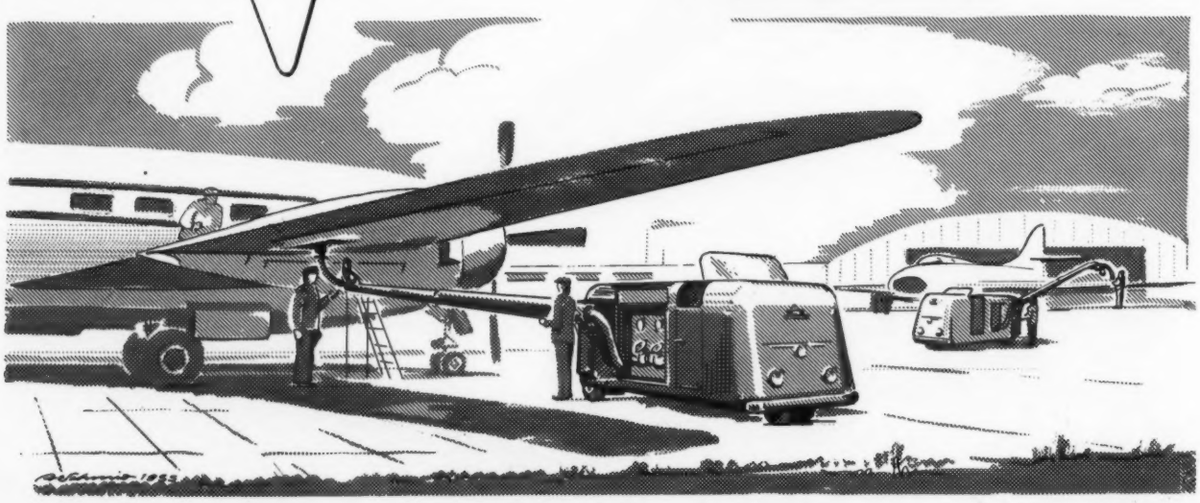

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Aircraft for this purpose do not require great speed but they must be:

(1) Simple to build—so that they may be provided in numbers at low cost and their production widely dispersed as a measure of protection against atomic attack.

(2) Simple to operate—so that they could, if necessary, be flown and serviced by reservists with the minimum of training.

(3) Rugged in construction—so that they can take off and land with ease on anything from an emergency landing-strip, on a beach or golf course, to the heaving deck of a small escort carrier in heavy weather.

(4) Efficient in operation for both search and strike.

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ALFA ROMEO. Via M. U. Traiano, 33. Milan. Piston and jet engines. Overhauls and repairs.

AERONAUTICA MACCHI. Varese. Jet, trainer and touring aircraft. Spares.

AERFER (Officine di Pomigliano d'Arco per Costruzioni Aeronautiche e Ferroviarie). Corso Umberto I°, 22, Naples. Jet aircraft and spares.

AGUSTA (Costruzioni Aeronautiche). Cascina Costa, Gallarate. Aircraft. Helicopters. Overhauls and repairs.

COMPAGNIA GENERALE ITALJET. Via Castelfidardo, 51. Rome. Take-off rockets and rocket projectiles.

FIAT. Corso Agnelli, 200. Turin. Conventional and jet aircraft and engines. Spares. Tools and equipment.

MICROTECNICA. Via Madama Cristina, 147. Turin. Navigation instruments, installations and synchronizing equipment.

NARDI (Costruzioni Aeronautiche). Forlanini Airport. Milan. Amphibians. Landing gear. Spares.

OFFICINE AERONAVALI. Lido di Venezia. Conversions, overhauls and maintenance of aircraft and engines. Mobile equipment for airports.

OLEODINAMICA MAGNAGHI. Via S. d'Ancona, 27. Milan. Installations, brakes, shock absorbers, propeller pitch regulators and hydraulic equipment.

PIAGGIO & C. Via A. Cecchi, 6. Genoa. Trainers and touring aircraft. Amphibians. Engines. Metal propellers.

SIAI MARCHETTI. Sesto Calende. Aircraft. Overhauls and maintenance of aircraft and engines.

SOCIETÀ AERONAUTICA ITALIANA ING. A. AMBROSINI & C. Viale Maino 23. Milan. Trainers and touring aircraft.

ARMS AND AMMUNITION

AGENZIA PRODUZIONI SPECIALI MECCANICHE. Via 20 Settembre, 5. Rome. Automatic arms. Ammunition. Ground installations for airports. Radioelectric equipment.

BERETTA ARMI. Via Tesio, 6. Brescia. Small arms of all kinds.

BORLETTI (Fratelli). Via Washington, 70. Milan. Fuses and regulators.

GENERALE INDUSTRIE METALLURGICHE. Borgo Pinti, 99, Florence. Ammunition of all calibres. Metal containers for projectiles.

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CONTRAVES ITALIANA. Via Tiburtina, 965. Rome. Electronic fire control systems.

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OFFICINE VIBERTI. Corso Peschiera, 249. Turin. Motor cranes. Fuel trucks. Servicing trucks.

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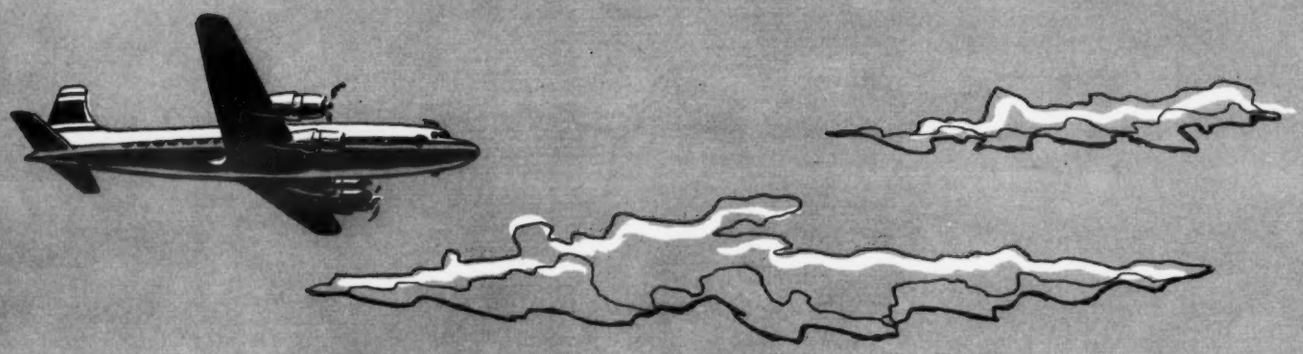

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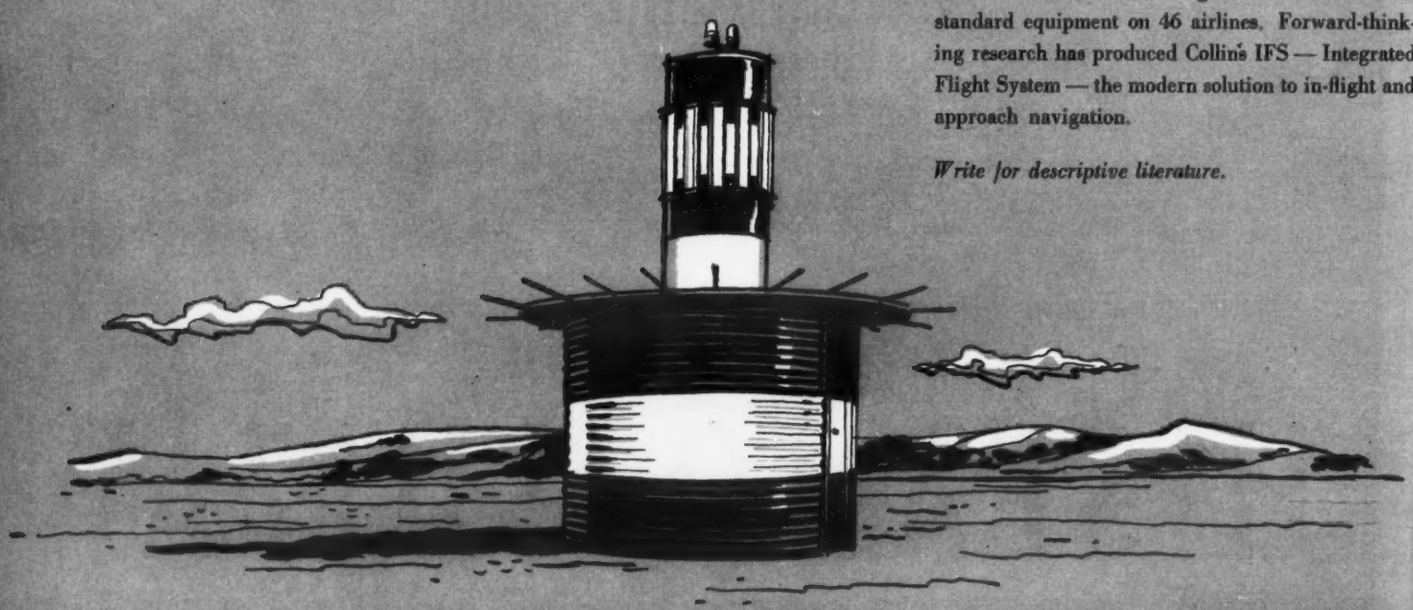

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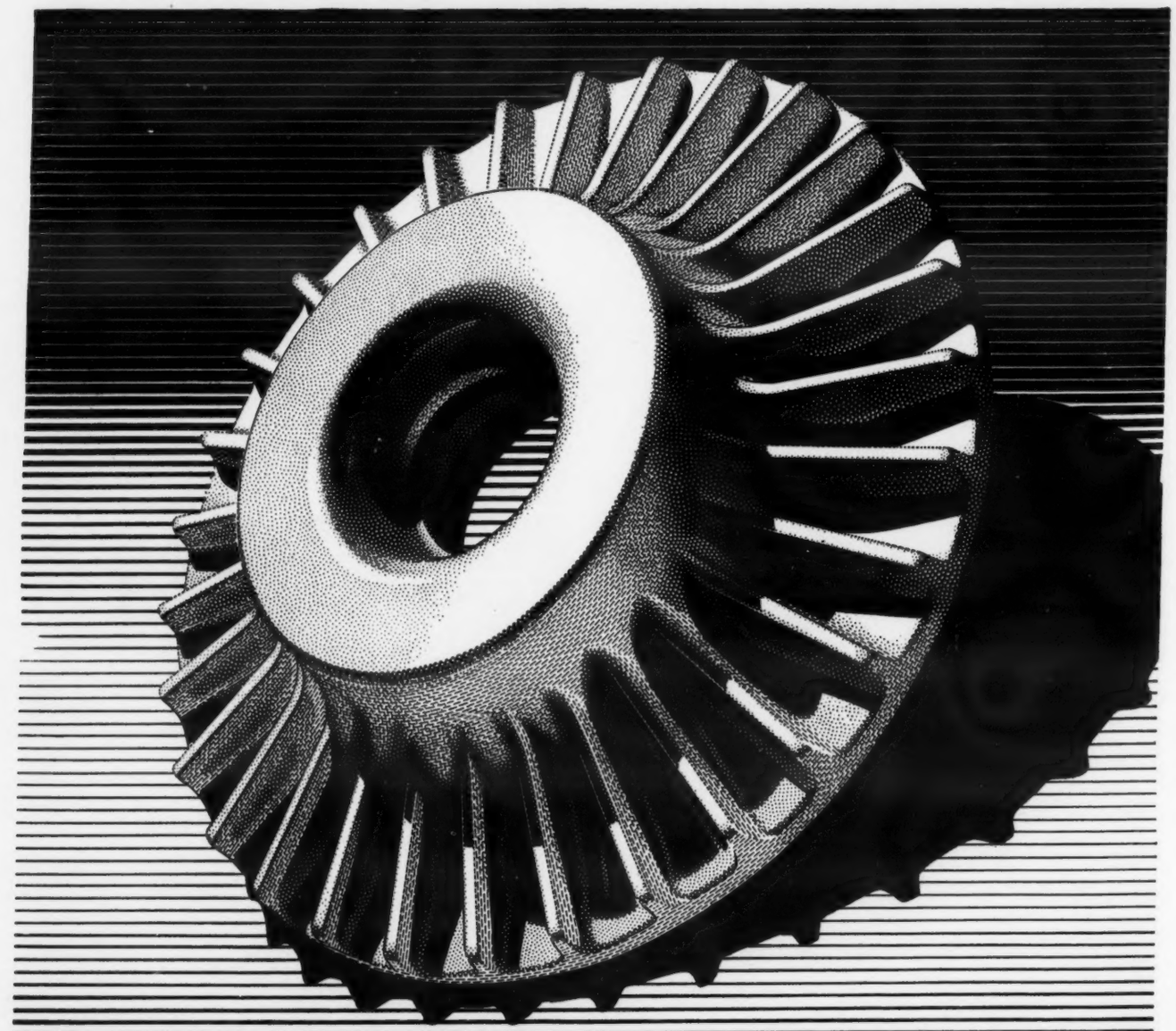

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ORYX : Napier's 750 gas h.p. turbo-gas-generator for helicopters propelled by jet reaction at the rotor blade tips. It weighs less, is less complicated and easier to maintain than conventional helicopter power systems. Now being developed as a power unit for the Percival P74 helicopter and the Fairey Rotodyne.

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DELTIC: 825–2,500 b.h.p. diesel engine—the smallest and lightest for its power output in the world. This means more cargo space in freighters and higher speeds for naval craft.

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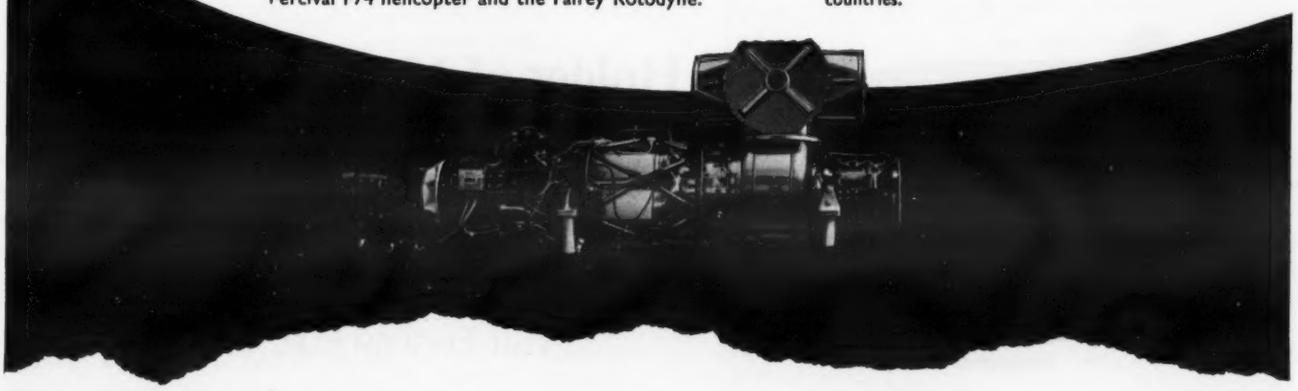

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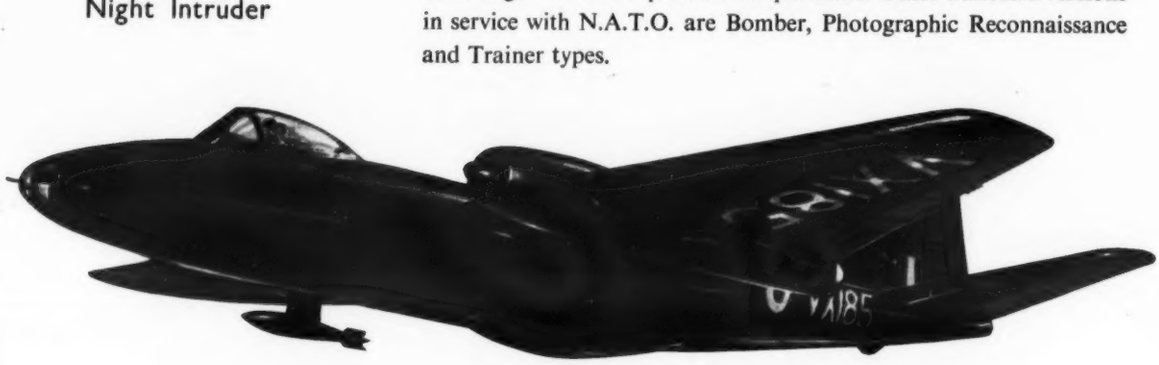

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How to sell N.A.T.O.?

21st Paris Aircraft Show: June 10th-19th, 1955

In purely external appearance this year's Paris Aircraft Show will open in much the same way as the last one in 1953. The official opening will take place two weeks earlier, on June 10th instead of June 26th, and when the strains of the Marseillaise ring out and the Garde Républicaine presents arms, President Vincent Auriol's place in the cortège entering the new *Palais du Salon de l'Aéronautique* at Le Bourget, will be taken by another amiable elderly gentleman, President René Coty.

This is when the first difference will become apparent. The President's suite will still include the appropriate members of the Cabinet, the heads of the three armed services and France's leading industrialists, headed by the President of the Aircraft Show. But in addition to the foreign air attachés, the dominant note will be provided by foreign uniforms of all kinds and colours. They represent N.A.T.O. and S.H.A.P.E., which have their headquarters in or near Paris. This time they come not as observers putting in a polite appearance, but as purchasers with their governments' detailed procurement programmes in their pockets.

*

Seven countries—France, Britain, Italy, the United States, Holland, Belgium and Luxembourg (the latter represented by its Transport Ministry)—are exhibiting this year. Though the catalogue lists only some 180 stands, the number of exhibitors is considerably larger since firms not wishing or able to take a booth of their own will show their products on the collective stands of the aircraft industry associations of Italy, Holland and Belgium. And aircraft of all nationalities will be lined up on the airport in front of the exhibition buildings, to arouse visitors' interest on the ground and in flight. France is a hospitable country and has opened the air space above Le Bourget to all firms desirous of coming to Paris.

The reader will doubtless have noted that the aircraft industries of Sweden, Spain and Switzerland are not this time among the exhibitors. The reason is obvious: *Paris this year is a N.A.T.O. Show.* These three countries are not—or in one case not yet—members of the North Atlantic Treaty Organization, and are thus not directly interested in selling to N.A.T.O.

The object of the 1955 Show is not merely to demonstrate the quality of the aircraft industries of France and her guests. It has a much more significant rôle to play, namely to give the French metropolis, the thousands of guests from all over the world and the press of all countries a tangible idea of N.A.T.O., still little more than a name to the man in the street.

*

A few weeks ago the heads of the North Atlantic Treaty Organization sat down together to discuss HOW TO SELL N.A.T.O., as the Americans put it. The final impetus to this increasingly urgent question had been provided by United Aircraft Corporation, of East Hartford, Connecticut, financially the world's most powerful aviation industrial concern, which has spent $3,500,000 on newspaper advertising in twelve languages to explain the tasks and aims of the North Atlantic Treaty Organization. HOW TO SELL N.A.T.O. . . From Supreme Commander General Gruenther, via Air Deputy General Norstad, Deputy Supreme Commander Field Marshal Montgomery and Secretary General Lord Ismay, all N.A.T.O. officers are interested in proving to the public that their organization is a good deal more than a home for "chairborne" generals. They aim to show how N.A.T.O. in practice holds the balance between East and West and can really ensure peace.

Programme of the 21st Aircraft Show

Le Bourget, Paris, June 10th-19th, 1955

June 10th: Official opening
June 12th: Commercial aviation day
June 13th: Helicopter day
June 15th: Light aircraft and sports flying day; arrival of the participants in the International Paris Air Rally, on the 50th anniversary of the Fédération Aéronautique Internationale
June 18th: Flying display for the guests of the *Union Syndicale des Industries Aéronautiques*
Lunch given by U.S.I.A.
June 19th: International flying display, open to the public.

Throughout the Show there will be demonstrations in flight of the aircraft on view outside the exhibition halls, and individual and formation demonstrations of French and foreign types.

Where can this be demonstrated better than in Paris, whither all aviation roads lead in June 1955?

*

The following examples show that progress is being made, technically and industrially, in the right direction.

A French-designed jet trainer, which promises to become the standard model for fourteen—soon fifteen—N.A.T.O. countries, is already flying. This is the Fouga *Magister.*

A few weeks ago the Pentagon ordered for N.A.T.O. a pre-production batch of a light, efficient and economical ground attack aircraft, an Italian tactical fighter with a British engine of small dimensions but high power—the Fiat G. 91 with a Bristol *Orpheus* axial-compressor turbojet. By the time the Paris Show opens its doors, the British Ministry of Supply may have cleared the *Orpheus* for display, and the Fiat G. 91 will be nearing completion. Here is an Italo-British design whose equipment can be completed by products of other countries, an aircraft which may also become a standard type for N.A.T.O. countries and be available to them for production under licence.

These are more than promises, they are the beginnings of a European cooperation without which the name of N.A.T.O. would remain sound and fury.

For the first time for many years 1955's guests in Paris will include German officers and industrialists. The West German delegation, headed by General Hans Speidel, who until recently was merely an observer attached to N.A.T.O., took its place as a full-scale member on May 15th, and German industrialists who will go to Paris this year as spectators may perhaps be exhibitors at the 22nd Show in 1957. At present they are waiting in the wings, like actors, for their cues. Within the next two years they must find their place in the N.A.T.O. cast.

What may be expected from the 21st Paris Aircraft Show on the technical side is described in the following pages. Here it remains merely to be added that once again Paris will be no purely national display, but a call for that cooperation without which there can be no Europe and no peace! *EEH*

Paris Show

The French Aircraft Industry in 1955

I. France's Reorganized Industry Pioneers in New Design Fields

BY INTERAVIA STUDY GROUP

During the years since the end of the war the French aircraft industry has gradually taken on a distinctive character and come to occupy a special place among the aircraft-producing nations. It is far from being the most powerful. Its labour force, scientific and industrial equipment, financial resources and markets place it behind the aircraft industries of the United States, Russia and Britain. It is not, like the British and American industries, based on the world's most advanced forms of propulsion. It did not, like the Anglo-Saxon countries and Russia, directly benefit from the tremendous progress made during World War II. On the contrary, the war destroyed its entire potential at that time. Again, unlike Germany's industry before its demise, it has not been directed towards radically new techniques. It has not specialized, like the Canadian industry, in production rather than research. Finally, unlike the Swedish industry which has been adapted to the country's domestic needs, it is still aiming to a certain extent at a kind of universalism, at any rate in the wide variety of its research, if not in production.

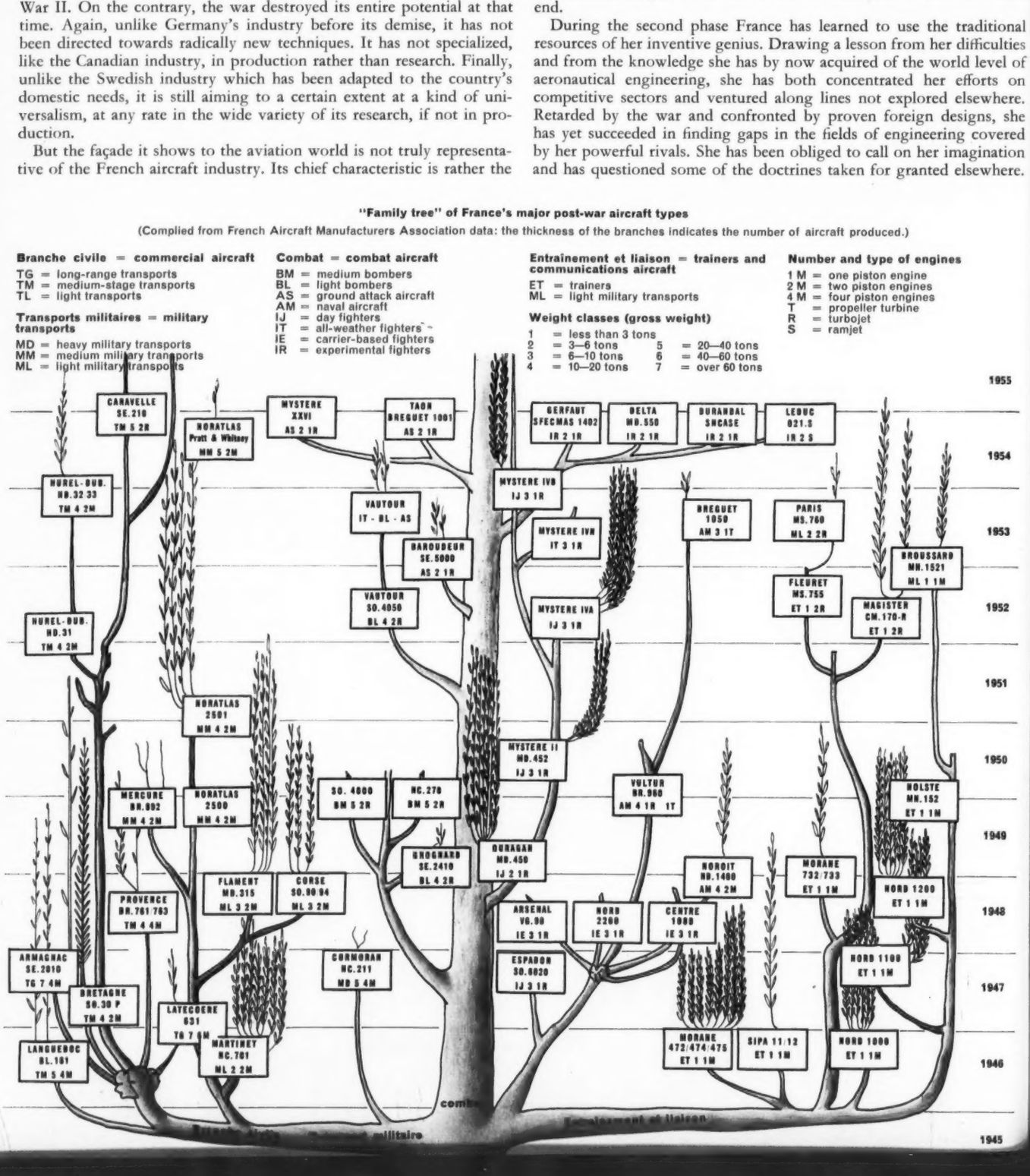
But the façade it shows to the aviation world is not truly representative of the French aircraft industry. Its chief characteristic is rather the "complementary" nature of its efforts during recent years, during which it has sought to supplement the work of others and to develop branches so far neglected by its competitors.

There are two main phases in the policies followed by France since 1945. During the first phase the industry, lacking full information of the advances made elsewhere in the war years, dispersed its efforts on the design and even the construction of almost all categories of equipment. Despite its lack of resources, it explored virtually the whole field of aeronautical design. At the end of two or three years it came to a dead end.

During the second phase France has learned to use the traditional resources of her inventive genius. Drawing a lesson from her difficulties and from the knowledge she has by now acquired of the world level of aeronautical engineering, she has both concentrated her efforts on competitive sectors and ventured along lines not explored elsewhere. Retarded by the war and confronted by proven foreign designs, she has yet succeeded in finding gaps in the fields of engineering covered by her powerful rivals. She has been obliged to call on her imagination and has questioned some of the doctrines taken for granted elsewhere.

"Family tree" of France's major post-war aircraft types

(Complied from French Aircraft Manufacturers Association data: the thickness of the branches indicates the number of aircraft produced.)


Branche civile = commercial aircraft
TG = long-range transports
TM = medium-stage transports
TL = light transports
Transports militaires = military transports
MD = heavy military transports
MM = medium military transports
ML = light military transports
Combat = combat aircraft
BM = medium bombers
BL = light bombers
AS = ground attack aircraft
AM = naval aircraft
IJ = day fighters
IT = all-weather fighters
IE = carrier-based fighters
IR = experimental fighters
Entrainement et liaison = trainers and communications aircraft
ET = trainers
ML = light military transports
Weight classes (gross weight)
1 = less than 3 tons
2 = 3—6 tons
3 = 6—10 tons
4 = 10—20 tons
5 = 20—40 tons
6 = 40—60 tons
7 = over 60 tons
Number and type of engines
1 M = one piston engine
2 M = two piston engines
4 M = four piston engines
T = propeller turbine
R = turbojet
S = ramjet
1955
1954
1953
1952
1951
1950
1949
1948
1947
1946
1945
CARAVELLE SE.210 TM 5 2R
NORATLAS Pratt & Whitney MM 5 2M
MYSTERE XXVI AS 2 1R
TAON BREGUET 1001 AS 2 1R
GERFAUT SFECMAS 1402 IR 2 1R
DELTA MD.550 IN 2 1R
DURANDAL SNCASE IR 2 1R
LEDUC 021.S IR 2 S
NUREL-DUB. NB.32 33 TM 4 2M
MYSTERE IVB IJ 3 1R
VAUTOUR IT - BL - AS
BARDUDEUR SE.5000 AS 2 1R
MYSTERE IVA IT 3 1R
BREGUET 1050 AM 3 1T
PARIS MS.760 ML 2 2R
BROUSSARD MH.1521 ML 1 1M
NUREL-DUB. NB.31 TM 4 2M
VAUTOUR SO.4050 BL 4 2R
MYSTERE IVA IJ 3 1R
FLEURET MS.755 ET 1 2R
MAGISTER CM.170-R ET 1 2R
NORATLAS 2501 MM 4 2M
MYSTERE II MD.452 IJ 3 1R
VULTUR BR.960 AM 4 1R 1T
MERCURE BR.892 MM 4 2M
NORATLAS 2500 MM 4 2M
SO. 4000 BM 5 2R
NC.270 BM 5 2R
ROLSTE MH.152 ET 1 1M
BROGNARD SE.2410 BL 4 2R
DURAGAN MD.450 IJ 2 1R
NORDIT NB.1400 AM 4 2M
MORANE 732/733 ET 1 1M
PROVENCE BR.761 763 TM 4 4M
FLAMENT MD.315 ML 3 2M
CORSE SO.90 94 ML 3 2M
ARSENAL VG.90 IE 3 1R
NORD 2200 IE 3 1R
CENTRE 1080 IE 3 1R
NORD 1200 ET 1 1M
ARMAGNAC SE.2010 TG 7 4M
CORMORAN NC.211 MD 5 4M
ESPADON SO.6020 IJ 3 1R
NORD 1100 ET 1 1M
BRETAGNE SO.30 P TM 4 2M
LATECOERE 631 TG 7 6M
MORANE 472/474/475 ET 1 1M
SIPA 11/12 ET 1 1M
NORD 1000 ET 1 1M
LANGUEDOC BL.161 TM 5 4M
MARTINET NC.701 ML 2 2M

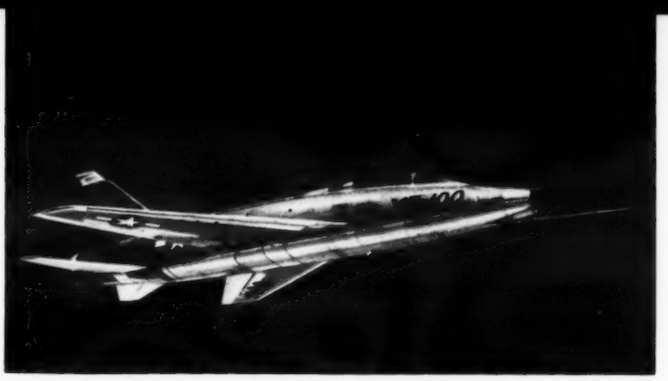
Today, thanks to these efforts, the French aircraft industry is able to sell licences for low-power turbojets and demonstrate a transport of low operating costs and an "all-airfield" combat aircraft, and tomorrow will try out a whole range of light fighters as its contribution to a reversal of the trend towards increasing weight in this aircraft category. This is also why it has embraced the idea of the twin-jet medium-stage transport and is well in advance of other countries in the field of ramjet propulsion. It may be argued that the only reasons why these "non-competitive" sectors have been left open is that they are of minor importance or without practical utility. The facts speak otherwise. Turboméca licences sell. They have made it possible to build jet trainers and communications aircraft, whose general configuration has been adopted elsewhere. The pitfalls of the high aspect ratio wing had long been known, but methods have been found of overcoming them, and Hurel-Dubois' aircraft reach their design performance. It has now been generally accepted that combat aircraft must be specialized and multi-purpose types abandoned, and a substantial number of low-weight interceptors and ground attack aircraft are being designed. In the field of ramjet propulsion, it seemed at one time as if the successful outcome of René Leduc's experiments would be retarded by their audacious scope. Yet the efforts made are beginning to pay off, and France has already solved some of the problems now puzzling other experimenters.

The French aircraft industry thus completes the research and production of other countries. But though it acts as a pilot industry in the complementary fields, it also stimulates more conventional development and the general progress of the aeronautical sciences.

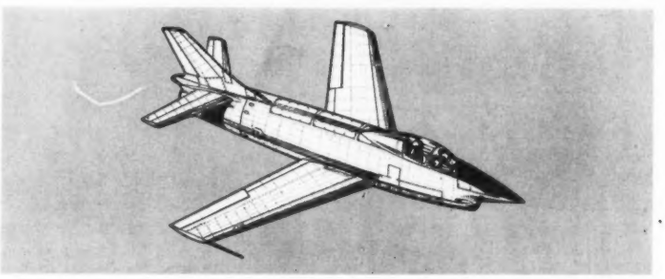
The limits to ambition

This special place which the French aircraft industry now occupies is the result of a long series of efforts in carefully planned directions. In its task of prospecting new ideas, this industry should be able to call on substantial funds for research and experiment. Though the funds granted represent about one third of the sums available for quantity production, the total resources allotted to aviation in France are still relatively small, and consequently the share allocated to scientific research and prototype design fall far short of what is needed. The *Union Syndicale des Industries Aéronautiques* last year published a booklet in which it pointed out that though credits granted for prototype development were increased by 147 percent between 1947 and 1953, the increase bears no relation to the rise in costs. It follows that, with the constant increase in research and development costs through the years, the number of new domains investigated has to be progressively reduced. However limited may be the tasks the industry wishes to undertake, its scientific research equipment (wind tunnels, test beds, experimental centres etc.) cannot be reduced below a certain level. On the contrary, since the industry is obliged to venture into new domains, this equipment should be particularly extensive.

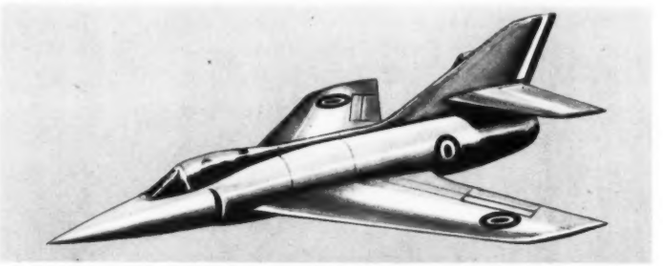
In the field of quantity production, the present state of the market open to the French aircraft industry adds to its difficulties. The Government is practically its only customer. A somewhat similar situation also exists in the United States and Britain, where more than 80 % of the expenditure on production is provided by the Government. But the American aircraft industry has orders several dozen times and the British three times as large as the French, which has to manage on about 100,000,000,000 francs ($250,000,000) a year. The increase in production



One of the aircraft categories that France has developed in competition with other countries is the interceptor fighter. Here America's and France's latest supersonic fighters, the North American F-100 *Super Sabre* (top) and Dassault *Mystère IV. B1* (bottom).



Rivals for N.A.T.O.'s ground attack aircraft: Italy's Fiat G. 91 (top); France's Dassault MD. 26 (bottom).



French aircraft manufacturers and their latest products

(Principal aircraft under development or in production)

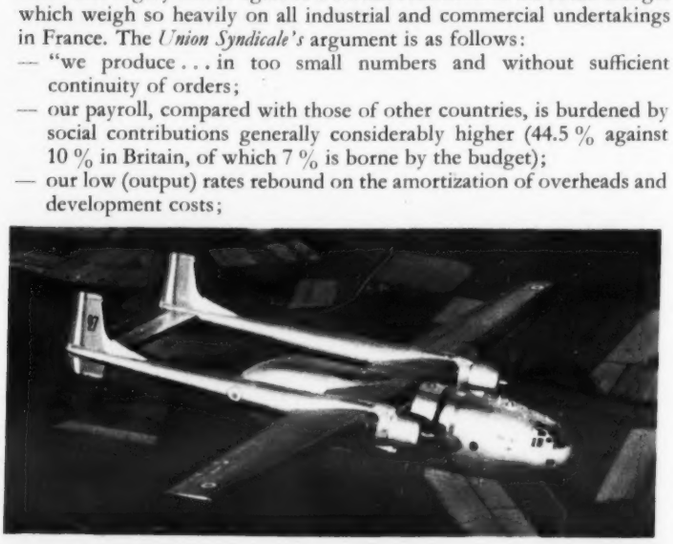
	BREGUET	DASSAULT	FOUGA	HUREL-DUBOIS	LEDUC	MORANE	SIPA	SNCAN	SNCASE	SNCASO	SFECMAS	M. HOLSTE	Total
Medium freighter								2501					1
Medium-stage passenger transport									SE. 210				1
Economical transport				HD.32/33									1
Light bomber										SO. 4050			1
All-weather fighter										SO. 4050			1
Medium interceptor		IV B.2											1
Light interceptor		MD. 550			021					SO. 9050	1402		4
Light ground attack aircraft	1001	22/24/26							SE. 5000				5
Jet trainer			CM.170R				200/300/400						4
Jet communications aircraft						MS. 760							1
Jet helicopter									SE. 3130	SO. 1221			2
Small transport												MH. 1521	1

costs is well known. The *Union Syndicale* also pointed out that whereas the sums allocated for production had increased by 168 percent between 1947 and 1953, the average cost of flying equipment had been multiplied by eight during the same period. Just as the limited credits allotted for development reduce research to a level incompatible with the French industry's present rôle, so the restricted national market prevents it from fully developing its production potential.

As is well known, the unit cost of production decreases as the number of aircraft built increases. The first fighters of a large production batch cost five to ten times as much as the last. The size of the market decides the length of the production run. To give rough figures, Russian production batches of medium-weight combat aircraft doubtless exceed 3,000, corresponding American orders exceed 2,000 and British are at least 600 to 700. French production series are generally much smaller. The Union Syndicale's booklet states that the order for MD. 450 *Ouragans* was finally limited to 350 aircraft, the *Mystère II* order to 150 and the *Mystère IVA* to 225 (including U.S. off-shore orders), and that, though Hispano Suiza has made over a thousand Hispano *Nene* jets, it had never received an order for more than 300 at a time. Hence the French industry is obliged to produce at the top of the price curve. Regardless of the efficiency of its production organization, the output level of its labour force and its labour costs, the cost of its finished products is automatically increased by a certain percentage. Moreover, a short production run has a relatively much higher burden to bear for scientific and technical overheads.

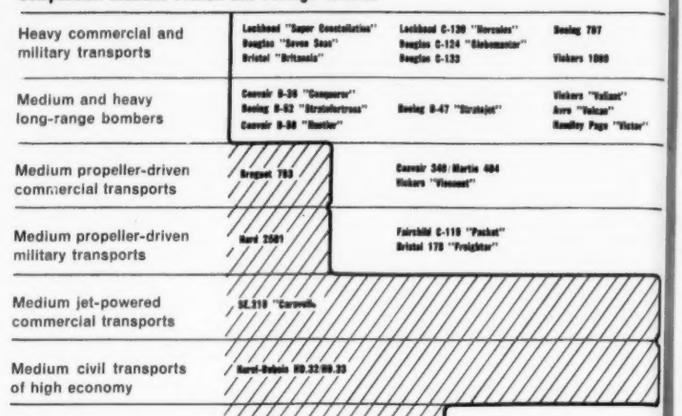
This situation produces two results. On the national level it tends to cut down the production run, since as the unit cost is high and the overall sum available for procurement is more or less fixed, the purchasing authorities have to content themselves with a smaller number of aircraft for a given sum. On the external level it restricts the export potential, since prices are higher than those of other exporting countries. Since it is difficult to expand the domestic market and practically impossible to break into the export market, there is little hope of breaking the vicious circle: an enlargement in the market would enable prices to be reduced by building larger numbers, but the export market cannot be tapped unless prices are reduced. The only remedy, according to the *Union Syndicale,* is for the Government to plan domestic requirements more thoroughly and to agree to a certain reduction in the social charges which weigh so heavily on all industrial and commercial undertakings in France. The *Union Syndicale's* argument is as follows:

— "we produce . . . in too small numbers and without sufficient continuity of orders;
— our payroll, compared with those of other countries, is burdened by social contributions generally considerably higher (44.5 % against 10 % in Britain, of which 7 % is borne by the budget);
— our low (output) rates rebound on the amortization of overheads and development costs;



Rival military transports: the French Nord 2501 *Noratlas* (top) and the American Fairchild C-119H *Super Packet* (bottom).

Competition between French and Foreign Aircraft



— we pay much higher prices for raw materials of French origin. The following are typical prices in France and Britain: special refractory steel sheet, 3,300 francs per kilogram compared with 1,225 francs; stellite for valves, 4,600 francs per kilogram compared with 2,900 francs; duralumin 50 % more in France;
— coal is 2,500 francs a ton dearer than in Britain;
— taxation amounts to 22 % on the production sector, whereas in Britain it is spread over other sectors of the economy and thus reduces export prices;
— imported machinery and tools, essential to our industry, are weighted with excessive customs duties which augment equipment investments".

Some of these handicaps, being of a domestic nature, could certainly be removed. The French economy, unlike the British, is not yet directed towards the export field, since France is less dependent than Britain on imports and hence on exports to balance payments.

Civil distrust, military confidence

On the domestic market the French aircraft industry should be supported by two pillars, military and civil customers. Within their limited means, the military have played their part, as in the United States and Britain. Although immediately after the war they used what the British and Americans had left over from the fighting, the progressive transfer to French military equipment was already prepared.

The five-year plan voted on August 19th, 1950 and the rearmament plan (law of January 8th, 1951) both aimed at adapting development and production to needs and rationalizing production by planning the quality and quantity of aircraft required by the air forces for the subsequent five years. Technical vicissitudes and above all the irregularity with which funds became available prevented these plans from being implemented in full. But they did achieve a certain stabilization of production machinery and prepare the majority of the first-class aircraft available in France today. On the military side the "customer" has tried,

either out of natural confidence, or obligation, or realization of the importance of a more firmly based aircraft industry, to play his part and to facilitate his supplier's difficult task.

On the civil aviation side, a different policy has been followed. French airlines, both government and private, have not been naturally attracted to the use of national equipment, as have American carriers, or encouraged, like the British, not to use American equipment except as a last resort. Their attitude has doubtless been influenced by the fact that American civil transports are in almost universal use on the world airline network. They could not have met the severe competition confronting them from the start by using equipment with less than the Americans' long experience. Their distrust of French aircraft was long-lived. It is only today that one civil carrier is discovering the qualities of a cargo aircraft such as the Nord 2501, though this model had been designed from the start to meet both military and civil needs. The *Union Syndicale* has pointed out that of the total of 600 commercial transports in service with airlines with headquarters in Europe only about twenty are of French design.

Are the French airlines responsible for the French industry's meagre participation in the commercial aircraft market? The French industry is not equipped to build either heavy military aircraft or long-range civil transports. Though it could produce airframes of the necessary high quality, proven French engines and equipment are lacking. In the present stage of aeronautical engineering it has been found that efficiency and reliability in engines and equipment can be obtained only through long experience and intensive large-scale operational testing. If no "test bench" in the form of several thousand military aircraft or several hundred civil transports, or a combination of the two, is available, technical development is impossible. French manufacturers have therefore had to fit their civil airframes with foreign power plant and equipment. This is what has been done to varying degrees in the *Armagnac*, *Bretagne* and *Provence*.

An old weakness: power plant

The French aircraft industry has been suffering for twenty years from its lag in power plant development. The difficulty here lies not in the actual engine designs, but in the absence of sufficiently intensive and wide-spread utilization which would enable engines to be improved and their endurance progressively lengthened. The war did the rest. As civil users have turned to American and British aircraft, the new engines developed in France have been designed primarily to satisfy military requirements, and the adoption and development of German B.M.W. designs has accentuated this tendency. Again by ignoring turboprop aircraft, civil users have condemned projects such as the SNECMA TB. 1000. Today, the two engine firms, S.N.E.C.M.A. and

Rival light jet bombers (and tactical aircraft): Britain's English Electric *Canberra B. 8* (top); France's SO. 4050 *Vautour*, of S.N.C.A. du Sud-Ouest (bottom).

Hispano Suiza, which produce medium-power turbojets, are supplying the air forces with the ATAR series and the *Nene, Tay* and *Verdon* family. For their civil aircraft, manufacturers have taken the Rolls-Royce *Dart* turboprop for medium-weight transports or the *Avon* turbojet for the high-speed medium-stage transport. On the other hand Turboméca has tackled a whole series of small power plants, neglected elsewhere, and thus enabled a range of light high-speed aircraft to be designed and constructed for training and communications duties. As already stated, this configuration has many attractions and has been adopted by aircraft industries in most other countries.

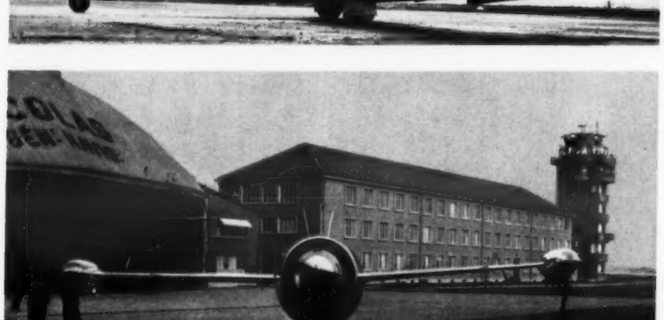
*

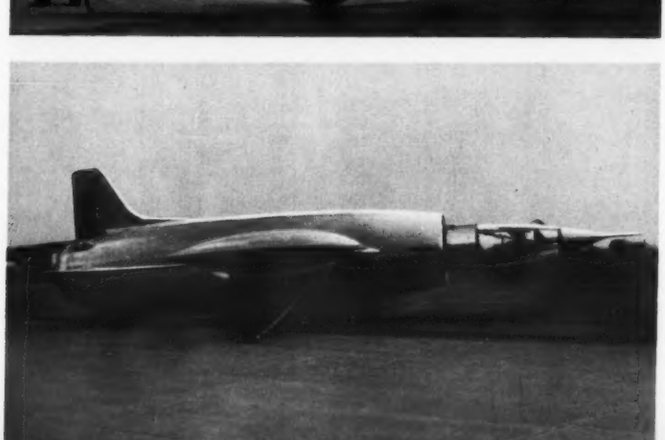
Conclusion

At present France employs about 75 % of the total labour force of the Western European aircraft industry (Britain excepted). Its research and experimental apparatus is practically the only one to have been rebuilt in Western Europe since the war. But above all, the experience of the past few years in the matter of design and production has done much to repair the damage done by the war. If the voice of wisdom and objectivity prevails in Europe, and the individual countries abandon their strictly national operations in favour of increasingly close collaboration with each other, the French aircraft industry will be able to play a major rôle.

The French industry is pace-maker in the design of jet-powered medium-stage commercial transports: here S.N.C.A. du Sud-Est's SE. 210 *Caravelle* for 70/91 passengers.

French designs with no present rivals (top to bottom): Hurel-Dubois HD. 32 medium commercial transport with narrow wing giving high operating economy; SE. 5000 *Baroudeur* fighter and ground attack aircraft for all types of terrain; Fouga CM. 170-R *Magister* light two-seat jet trainer; Leduc 021 experimental ramjet aircraft, predecessor of a ramjet combat aircraft.





Major French and Foreign Turbojets

Thrust class	France	U.K., U.S.A., U.S.S.R.
Under 400 lbs. (180 kg)	Turboméca Piméné (240 lbs.) Turboméca Palas (330 lbs.)	
400—1,000 lbs. (180—450 kg)	Turboméca Soulor (700 lbs.) Turboméca Aspin (730 lbs.) Turboméca Marboré (880 lbs.)	Fairchild J-44 (1,000 lbs.)
1,000—2,000 lbs. (450—910 kg)	Turboméca Gourdon (1,460 lbs.)	A.S. Adder (1,050 lbs.) A.S. Viper (1,640 lbs.) R.-R. Soar (1,760 lbs.)
2,000—3,000 lbs. (910—1,360 kg)	A.S. Dassault Viper (2,200 lbs.) SNECMA R.105 (2,640 lbs.) Hispano R.800 (2,640 lbs.) Turboméca Gabizos (2,425 lbs.)	
3,000—5,500 lbs. (1,360—2,500 kg)	Hispano Nene (5,000 lbs.)	D.H. Goblin (3,500 lbs.) Bristol Orpheus (4,850 lbs.) D.H. Ghost 3 (5,000 lbs.) R.-R. Nene 3 (5,000 lbs.) Westinghouse J-34 (3,300 lbs.) Allison J-35 (5,300 lbs.) G.E. J-47 (5,500 lbs.) M.003.E (3,750 lbs.) M.004.H (4,000 lbs.) RD. 45 (5,000 lbs.)
5,500—7,500 lbs. (2,500—3,400 kg)	Hispano Tay (6,200 lbs.) SNECMA ATAR 101 C (6,200 lbs.) SNECMA ATAR 101 D (6,600 lbs.) SNECMA ATAR 101 E (7,300 lbs.)	R.-R. Avon RA.2 (6,000 lbs.) R.-R. Avon RA.3 (6,500 lbs.) R.-R. Avon RA.22 (7,150 lbs.) R.-R. Avon RA.7 (7,500 lbs.) A.S. Sapphire (7,500 lbs.) P. & W. J-48 (6,300 lbs.) C.W. J-65 (7,200 lbs.) Westinghouse J-40 (7,500 lbs.) Avro Orenda (Canada) (7,050 lbs.)
7,500-10,000 lbs. 3,500—4,500 kg	Hispano Verdon (7,700 lbs.) SNECMA ATAR 101 F (reheat) (8,400+ lbs.) SNECMA ATAR 101 G (reheat) (9,250 lbs.)	R.-R. Avon RA.21 (8,050 lbs.) R.-R. Avon RA.14 (9,500 lbs.) R.-R. Avon RA.28 (10,000 lbs.) G.E. J-73 (9,000 lbs.) M. 018 (7,700 lbs.)
over 10,000 lbs. (4,500 kg)	SNECMA Vulcain (13,200 lbs.)	A.S. Sapphire SA.7 (10,200 lbs.) A.S. Sapphire SA.9 (11,000+ lbs.) Bristol Olympus (11,000+ lbs.) R.-R. Conway (13,000 lbs.) D.H. Gyron (15,000+ lbs.) P. & W. J-57 (10,000+ lbs.) Allison J-71 (reheat) (14,000 lbs.) C.W. T-67 (15,000 lbs.) P. & W. J-75 (15,000+ lbs.)

II. Neck and Neck with Foreign Rivals

BY
INTERAVIA STAFF REPORTER E. B.

At the time of the last Paris Show Interavia *remarked that France had almost caught up with her foreign rivals after an eight-year race. Today, two years later, it is quite clear that the French have made further progress, that their aircraft industry—airframes, engines and equipment—is running neck and neck with those of other countries. France now has her full say in the international aviation market...*

It is to be hoped that the Government departments responsible for research contracts and procurement will not fail the French industry, that they will provide the necessary encouragement where this is justified by technical performance. *Editors*

A slight misunderstanding

"...It's a real scandal. They are letting their imaginations run wild... at government expense. Dozens of projects and a few prototypes, and none of them with the slightest hope of going into production..." Such was the forceful comment of an indignant Frenchman in the critical days of 1949.

As its turned out later, his criticism was wide of the mark. Even at that time it was based on shaky foundations, and today all justification for it has vanished. However, it was a pardonable error. During the immediate post-war period it did look at times as if the French aircraft industry were building castles in the air. But what was completely overlooked was that this war-scarred industry had practically no government support and that research and development seldom, if ever, led to firm orders. The Paris Show held in the late autumn of 1946 revealed, to the general surprise, a host of interesting new designs, which were ample evidence of the prodigious efforts being made to overcome serious difficulties. But these aircraft and engines—at first existing only in the form of models and occasional prototypes—showed little tendency to go into production during the succeeding years. However, the designs were direct or indirect predecessors to today's production models or rendered valuable service as flying test beds for accessories and equipment. They provided the French airframe, engine and equipment industry with the experience without which the 1955 Aircraft Show would be inconceivable. It suffices to recall here such typical guinea pigs as S.N.C.A. du Sud-Est's *Grognard,* or S.N.C.A. du Sud-Ouest's *Espadon* and SO. 4000, which enabled engines and equipment, metal bonding and sandwich construction to be tried out.

Today, at the close of this eventful preparatory period, not even the worst pessimist can deny that France now has a respectable output of aircraft.

The industry has been spending money

It is not only French inventiveness that is at the bottom of this success. Realistic planning and the wide-spread adoption of modern aircraft production methods also play a decisive part. There is scarcely a major plant in the airframe, engine or equipment industry that has not thoroughly modernized its tooling during the past few years. The 60,000 people now working in the French aircraft industry have become acquainted with the advantage of "colour conditioning", in which tools and machines are painted bright lively colours. The result has been an improvement in morale and productivity and a reduction in the accident rate to a negligible figure.

In the organizational field there is a marked tendency for bigger undertakings to make their operations autonomous. For example, well-equipped laboratories enable S.N.C.A. du Sud-Ouest to carry out its own investigations into metal bonding, composite structural materials and plastics, such as are used in the twin-jet *Vautour.*

Société Nationale d'Etude et de Construction de Moteurs d'Aviation (S.N.E.C.M.A.) also spends large sums to make itself independent both in production and in the testing of finished products. Dozens of test beds for piston engines, turboprops and turbojets, pulse-jets and rocket engines have been erected at Melun-Villaroche during the past two years; laboratories and wind tunnels are provided for comprehensive operational ground testing of new or overhauled engines before delivery. Thanks to these installations costly flight testing can be cut down to the essential minimum.

It would be outside the scope of this article to give details of the research institutes and installations available to the French aircraft industry. Reference may, however, be made to two reports in earlier issues of *Interavia:* Maurice Roy, Director of O.N.E.R.A.: "Aeronautical Research in France" (No. 7, 1953) and Chief Engineer P. Carrière (No. 5, 1955; "The Aerodynamic Laboratory at Vernon").—Some details of S.N.E.C.M.A.'s test centre will be published after the Paris Show.

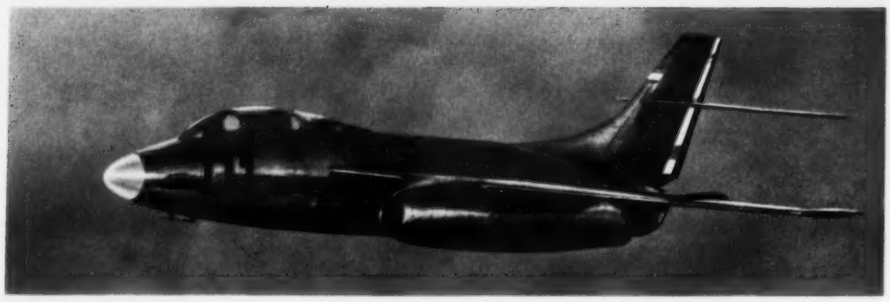
*

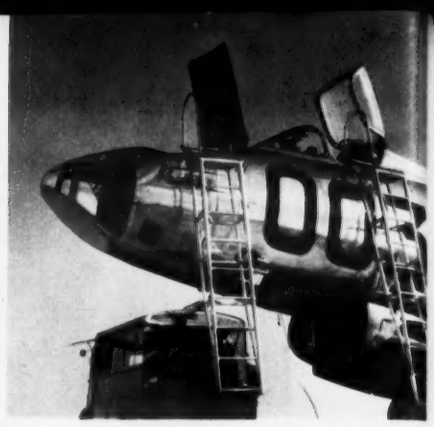
QUANTITY PRODUCTION, REDUCING COSTS

Combat aircraft off the assembly line

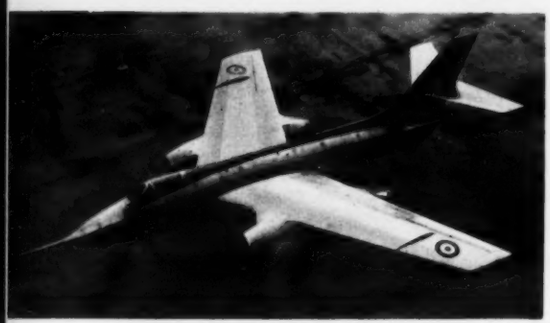
The imperative need for reducing production costs, especially of military aircraft, without damaging performance is today recognized throughout the world. The advocates of stripped, and hence cheaper, fighters and ground attack aircraft (cf. *Interavia* No. 3, 1955: "Pocket-Size Combat Aircraft") have made many disciples, particularly in Europe.

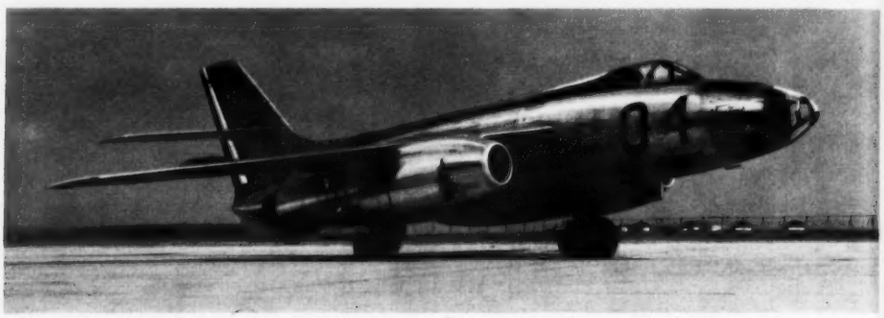
At the Government firm of S.N.C.A. du Sud-Ouest three aircraft types bear witness to these efforts to reduce costs and weight of flying equipment. They are the twin-jet *SO. 4050 Vautour,* now in production, the *SO. 9000 Trident* (prototype of the *SO. 9050* supersonic interceptor with combination power plant; two Dassault/Armstrong Siddeley *Viper* jets of approx. 1,640 lbs. take-off static thrust each at the wing tips and a SEPR rocket engine—three burners—in the fuselage rear) and the SO. 1221 *Djinn.* The *Trident* may be regarded as a particularly economic solution for an aircraft of its class, as it costs only about one third as much as a *Sabre* or a *Hunter.* The reduction in cost is due primarily to the relatively cheap rocket engine, as well as to the light, but rugged, airframe structure. S.N.C.A.S.O. an-





S.N.C.A. du Sud-Ouest's highest trump card is the twin-jet SO. 4050 *Vautour*, which is in production as all-weather fighter (two-seat; top left), ground attack aircraft (single seat; bottom left) and bomber (two-seat; right).





nounced some time ago that the *Trident's* short straight wing (span approx. 25 ft.) weighs only about half as much as a swept wing of corresponding dimensions.— Details of the SO. 9000 and SO. 9050 have not yet been released to the public, though certain disclosures may be expected to be made during the Show, in which case they will be included in later reporting on the Show. However, it is already clear that the *Trident* is one of the fastest aircraft ever built in Europe. Its degree of aerodynamic refinement can be judged from the fact that it has flown at Mach 1-plus on its two auxiliary jets alone.—The third model, the *SO. 1221 Djinn* helicopter driven by compressed air nozzles, if built in suitable quantities, should cost little more than a light truck. The development story of the *Djinn*, which began during the war, progressed via the piston-engined *Ariel I* (with jet-driven rotor) of autumn 1946 and the 1949 *Ariel II*. Pure turbine power was applied for the first time in the *Ariel III*, which features an *Arrius I* combination (of a 240 h.p. Turboméca *Artouste* driving a centrifugal compressor to supply air to the blade tips). All *Ariel* models have combustion chambers at the rotor blade tips, a principle that was discarded in the *Djinn;* in the latter the rotor is driven by pure air nozzles, the power plant being a Turboméca *Palouste* turbine air generator of 240 h.p.—Extensive flight testing during recent months has proved the value of this extremely economical rotary-wing machine under the most difficult operating conditions (tests on the Jungfraujoch and Mönch in the Bernese Alps). On the strength of such convincing results, large-scale production of the *Djinn* was decided upon, to meet not only French but also growing foreign demands.

The highest trump in S.N.C.A.S.O.'s hand, however, is the SO. 4050 *Vautour* already referred to. The first pre-production model, the SO. 4050-04, of this twin-jet all-weather fighter, ground attack aircraft and bomber was officially handed over to the French Air Force on March 25th, 1955; the first production models will be delivered in the spring of 1956.

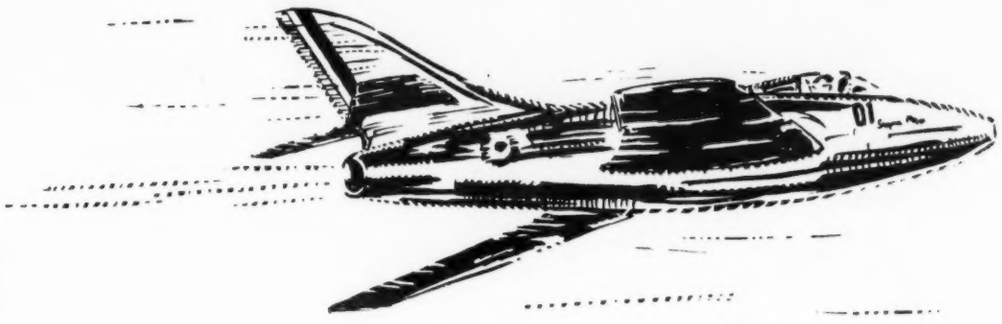
Designed for high subsonic speeds at low altitudes and for Mach 1-plus in dives at higher altitudes, the SO. 4050 can carry a variety of military loads, including a tactical A-bomb, with practically no change in performance. The ground attack and all-weather fighter versions are armed with two 30 or 37-mm cannon, and a choice of rocket projectiles, guided missiles, napalm containers etc. can be carried in the fuselage.

The *Vautour* can be converted for its various duties without modification to its basic structure and using more than 80% of all parts. Only the cabin arrangement and fuselage nose are modified for the different versions. The ground attack version is a single-seater, whereas a crew of two is provided for other missions, a radio operator in the all-weather fighter, and a bombardier (in a transparent nose) in the bomber version.

From the point of view of cost this versatility offers virtually unbeatable advantages. The bomber version, for example, is reported to cost only about one seventh as much as a modern medium bomber, a result that has been obtained by extensive simplification in structure, the use of ultra-modern light-weight construction methods and rationalization of production. A substantial saving in man-hours was achieved by the metal-bonding process, applied here for the first time to "vital parts" (the stiffeners for the stressed wing skin). For further information the reader is referred to a series of articles in

(continued on p. 393)

Fitted with a SEPR rocket motor and two Dassault (Armstrong Siddeley) *Viper* turbojets, the *SO. 9000 Trident* is a prototype for the SO. 9050 light supersonic interceptor.



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PLASTICS
CINEMATOGRAPHY

CALENDAR OF EVENTS

Third National Foundry Congress, organized by ASSOFOND and A.M.M.A. (September 28th, 29th and 30th — October 1st, 1955)
subject: **Experience of engineering and foundry designers**

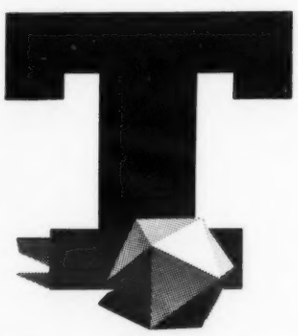
International demonstrations of agricultural and special machinery (at the National Agricultural Machinery Centre, Mirafiori — October 1st, 2nd and 3rd)

National Congress on the use of machinery in small agricultural undertakings (October 1st and 2nd)

Seventh International Plastics Congress under the auspices of I.S.O. TC 61 (October 3rd, 4th and 5th)
subject: **Plastics in their industrial and civil applications, with special reference to the Engineering, Electronics, Textile and Building Industries**

Seventh International Cinematographical Congress (October 6th, 7th and 8th)
subject: **New Technical Methods of Photography and Projection**

Seventh International Film Week
International Technical and Scientific Press Show
Sestriere meeting on snow clearance methods — February 1956



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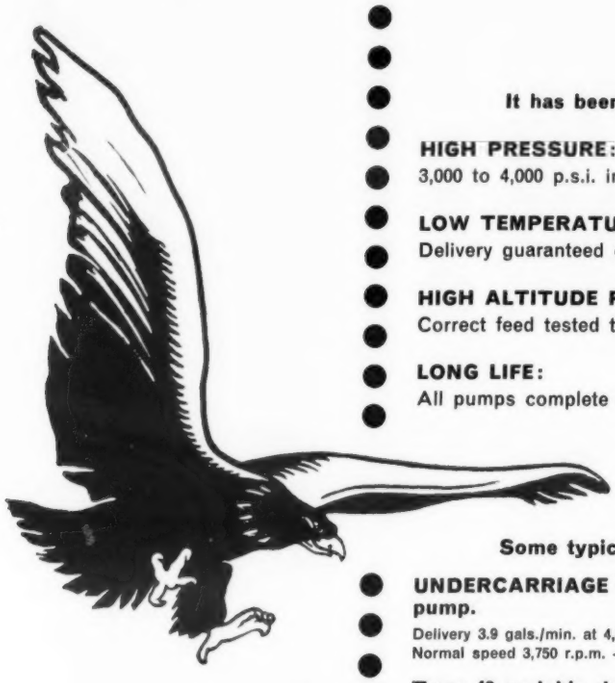

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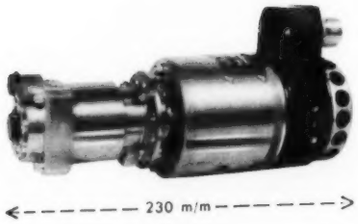

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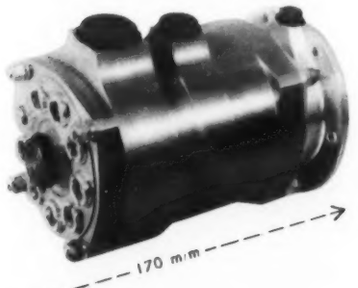

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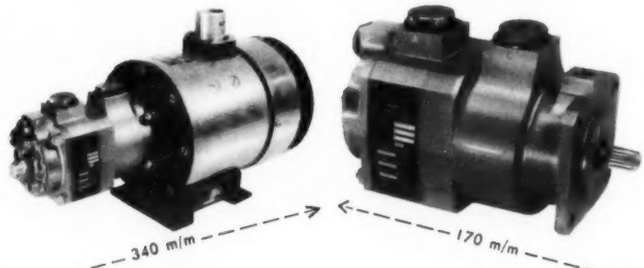

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(continued from p. 388)

Interavia No. 3, 1954 on the *Vautour's* design principles, technical data and flying qualities.

From the engine point of view the problem of adaptability was solved by suspending the two nacelles under the wing, away from the fuselage. In addition to simplifying maintenance, this arrangement enables the SNECMA-ATAR 101 D or 101 E (6,600 or 7,260 lbs. s.t.) to be replaced, if required, by other axial turbojets of similar or higher power. For experimental purposes—and probably to demonstrate its adaptability—the third *Vautour* prototype was fitted with *Sapphire SA.6s*, while *Avon RA.14s* were tried in one of the pre-production models.

Avions Marcel Dassault are engaged on large-scale production of fighters and fighter-bombers for the Armée de l'Air and for N.A.T.O. air forces. *Interavia's* forecast of 1950-51 that Dassault—the "strong man" of France's private aircraft industry—would continue to be a major supplier of fighters for many years to come has been proved correct. After completion of 350 models of the MD.450 *Ouragan* single-seat fighter, the next step is to the *Mystère* and today's *Super Mystère*.

To an even more marked extent than other firms, Dassault follow the most up-to-date production principles, as evidenced by their ultra-modern machine tools. It was not without justification that the Symington-Bridges Report (cf. *Interavia* No. 12, 1954) stated that workmanship at the Dassault plants is "far above the average and would compare favourably with the best in the United States." The same Report estimated the Dassault plants' potential output capacity at 200 aircraft a month, though present equipment suffices for only 50 to 75 jet fighter airframes—and then only if about 30% of the work is sub-contracted.

Needless to say, the preoccupation with keeping down costs was an ever-present one in the design of the *Mystère IIC*, now in production, as well as the *Mystère IV A*, *Mystère IV B.1/B.2* and *Super Mystère* about to go into production. Fighters of this class, however, cannot be "stripped" beyond a certain point, on account of their equipment. Gross weight of these models is approx. 16,500 lbs.

A departure from the *Mystère* and *Super Mystère* line is shown by the *Dassault 550* delta-wing interceptor and the *Mystère 26* single-seat ground attack aircraft (despite its name, the latter bears little resemblance to the normal *Mystère* class). Both models follow strictly light-weight construction principles, and as regards performance the *Mystère 26* should come very close to meeting N.A.T.O.'s specification for a ground attack aircraft. However, neither the 550 nor the *Mystère 26* yet figure on Dassault's production programme, though a 550 prototype has meanwhile begun flight tests.

Transports, civil and military, are also in production

It is not only in regard to military aircraft that the question of costs is constantly gaining in importance. The success or failure of commercial aircraft also depends largely on their cost price. This is not the place to go into the complex problems of cost reduction, for example in an aircraft of the *Nord 2501 Noratlas* class. Suffice it to say that this aircraft should have a particular appeal for airlines who must work from relatively primitive airfields and who need a machine that can be easily converted, with the minimum of equipment, from passenger to freight or mixed passenger/freight configurations.

Although the *Noratlas* is to be used primarily as French Air Force troop and supplies transport (71 of the 160 ordered have been delivered at the time of writing), the French airline Union Aéromaritime de Transport uses two on its freight services in West and Equatorial Africa; another eight are to be supplied to Israel, and the aircraft has aroused considerable interest in South America because of its versatility. S.N.C.A.N.'s sales efforts are therefore being concentrated primarily on the South American and Middle East countries.

Now that the *Noratlas* has overcome its teething troubles—which no new design escapes—S.N.C.A. du Nord are experimenting with methods of improving its operational qualities: installation of two Turboméca *Marboré IIs* of 880 lbs. s.t. each as auxiliaries to the SNECMA/Bristol *Hercules 738* piston engines; project for a Nord 2503 version with Pratt & Whitney R-2800-CB.17 with a take-off power of 2,500 h.p. (compared with the *Hercules'* 2,040 h.p.). The latter has been designed with an eye on airlines using primarily Pratt & Whitney engines.

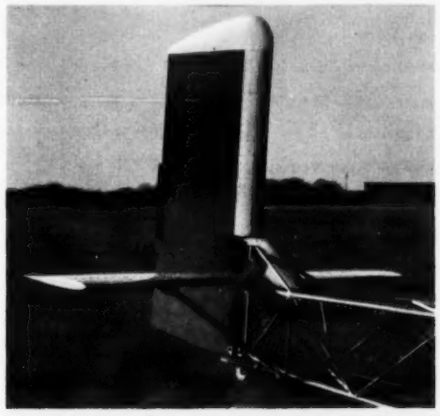
It is too early to assess the future sales prospects of the *Noratlas*. S.N.C.A. du Nord is at present negotiating with a number of potential customers, and further civil and military orders for one or other of the versions may doubtless be expected.

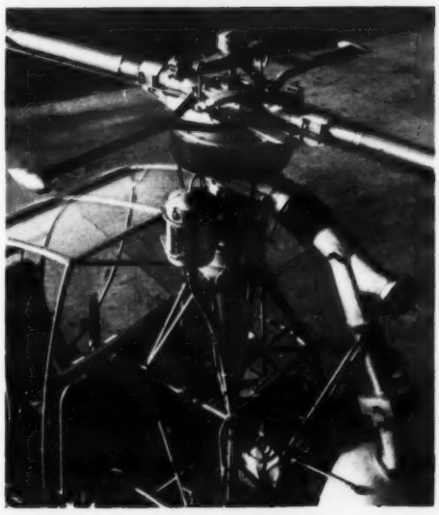
Economy in operation and exceptional performance and transport capacity are the main features of the HD.32 narrow-wing passenger and freight transport of *Société des Avions Hurel-Dubois*. Quantity production of the various versions of this aircraft is still only in preparation, though by the time these lines appear in print the die will probably have been cast. At any rate, Hurel-Dubois has concluded an agreement for S.N.C.A. du Sud-Est to take over production and sale of the HD.32 and its versions.

The joint preparations being made by the two firms (tooling etc.) should suffice for production of 150 aircraft, the first of which, at a unit price of 145,000,000 francs, could be delivered in the second half of 1956. There are several different civil and military versions, under the designations HD.321, HD.34, HD.35 and HD.36 (see table), for passengers and freight, aerial survey or anti-submarine operations.

As for trainers...

In the production of trainers, especially light high-performance jet trainers, France is without





Further evidence of S.N.C.A. du Sud-Ouest's efforts to reduce the weight and cost of aircraft is provided by the *SO. 1221 Djinn* two-seat helicopter. Of special interest are the simple structure of the tail boom and the rotor head and the design of the cabin.

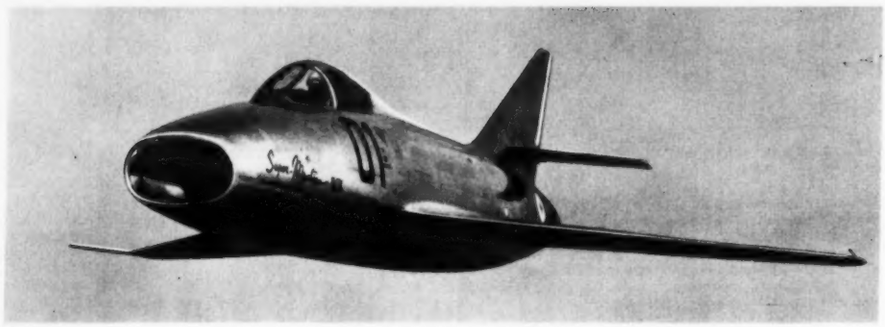
MAKER AND TYPE	Application	POWER PLANT			DIMENSIONS AND WEIGHTS				
		Maker and type	Take-off power		Span or rotor diameter	Length	Wing area or rotor disc	Weight empty	Gross weight
			h.p.	lbs.	ft. ins.	ft. ins.	sq. ft.	lbs.	lbs.
Paul Aubert PA. 204 Cigale Major	A	SNECMA 4L00, 4L02 Lycoming 0-290-D2 or Lycoming 0-320	135...167	—	32′ 9″	24′ 3.5″	138.8	1,410	2,580
Paul Aubert PA. 300 Grillon	A	—	—	—	—	—	—	—	—
Paul Aubert PA. 400 Lucane	A+C	2×Potez 6D00 (or Potez 4D31)	2×240	—	47′ 7″	32′ 9″	248	3,920	6,390
Boisavia B. 605 Mercurey	A	SNECMA 4L02	167	—	37′ 4″	23′ 7.5″	app. 190	1,430	2,580
Boisavia B. 260 Anjou	A	2×SNECMA 4L02	2×167	—	42′ 2″	22′ 6.5″	231.4	1,885	3,420
Bréguet 763 Provence	C	4×Pratt & Whitney R-2800-CA.18 Double Wasp	4×2,400	—	141′ 0″	95′ 0″	1,998.9	68,300	113,500
Bréguet 940-01	C	4×Turboméca Turmo II	4×395	—	52′ 6″	37′ 9″	495.5	8,880	14,330
Bréguet 1001 Taon	BA	Bristol Orpheus	—	app.4,850	—	—	—	—	—
Bréguet 1050	BA	1×R.-R. Dart turboprop	—	—	—	—	—	—	—
Bréguet 1100	BA	2×turbojets	—	2×2,200	51′ 2″	43′ 11.5″	387 5	—	18,080
Maurice Brochet MB. 100	A	Hirth 504-A	105	—	34′ 10″	21′ 4″	152.8	1,025	1,720
Maurice Brochet MB. 120	A	Continental C. 90	90	—	—	—	—	—	—
C.A.B. Supercab	A	Continental C. 90	90	—	26′ 11″	18′ 0″	110.8	880	1,360
Dassault MD. 450 Ouragan	B	Hispano Suiza Nene 104	—	5,000	40′4″/43′2″	35′ 3″	251.9	9,130	13,600
Dassault MD. 452 Mystère II C	B	SNECMA-ATAR 101 D.1	—	6,610	36′ 5.75″/ 42′ 9.75″	38′ 6.25″	326.1	11,515	16,440
Dassault Mystère IV A	B	Hispano Suiza Tay 250 A Hispano Suiza Verdon	— —	6,280 7,720	36′ 5.75″	42′ 2″	344.4	12,520	16,310
Dassault Super Mystère IVB.1/IVB.2	B	HS/R.-R. Avon RA. 7R + reheat SNECMA-ATAR 101 G + reheat	— —	app.10,000 with reheat	36′ 5.75″	43′ 11.5″	344.4	—	app.18,520
Dassault Mystère IV N	B	HS/R.-R. Avon RA. 7R + reheat	—	app.10,000	36′ 5.75″	48′ 6.5″	344.4	—	app.17,600 to 19,800
Dassault Mystère XX B/XX N	B	HS/R.-R. Avon RA. 14 + reheat (?)	—	10,000 with reheat	—	—	—	—	—
Dassault Mystère XXVI	BA	Bristol Orpheus	—	app. 4,850	25′ 5.5″	37′ 2″	—	—	—
Dassault MD. 550	BA	Dassault MD. 30 R (Viper) + reheat	—	—	app. 25′	—	—	—	—
Druine Turbulent	A	Volkswagen engine	25	—	21′ 6″	17′ 2.5″	20.7	—	510
Druine Turbi	A	Beaussier (45 h. p.), Walter or Continental, Minié or SNECMA	45/75	—	28′ 6.5″	22′ 3.75″	145.3	—	1,070
Farman Monitor I	AB+AC	SNECMA-Renault 4 Pei	138	—	30′ 11.5″	22′ 3″	150.7	—	1,810
Farman Monitor II	AB+AC	Salmson 8 AS04	256	—	32′ 7″	23′ 11″	app. 150	—	1,770
Farman Monitor III	AB+AC	SNECMA-Régnier 4L26	167	—	32′ 7″	23′ 0″	app. 150	—	—
Fouga CM. 170-R Magister	AB	2×Turboméca Marboré II	—	2×880	37′ 1″	32′ 9.75″	186.2	4,265	6,280...6,980
Hirsch M. Ae. RC. H 100	X	2×SNECMA-Régnier	2×95	—	28′ 2″	24′ 7.4″	—	1,995	2,910
Max Holste MH. 1521 Broussard	C+D	Pratt & Whitney R-985 Wasp Junior	450	—	45′ 1″	28′ 2.5″	273.4	3,210	5,400
Hurel-Dubois HD. 32	D	2×Pratt & Whitney R-1830-92 Twin Wasp	2×1,200	—	148′ 7.5″	76′ 4″	1,076.4	24,690	39,680
Hurel-Dubois HD. 321	D	2×Wright R-1820-9 HE	2×1,475	—	148′ 7.5″	76′ 4″	1,076.4	25,240	44,090
Hurel-Dubois HD. 45	D	2×turbojets (HS/R.-R. Avon?)	—	2×8,800 to 10,000	147. 6′	98. 4′	1,180	—	91,000 to 95,000
Hurel-Dubois HD. 70	D	2×R.-R. Dart RDa. 6	2×1,550	2×365	105′	72′ 2″	560	—	36,400
Leduc 021	X	Leduc ramjet plus 2×Turboméca Marboré II (2×880 lbs.)	—	app.14,300 at 620 mph. at sea level	38′ 0.5″	41′ 0″	236.8	8,380	13,230
Leduc 022	X	Leduc ramjet (more powerful than in 021) + 1 SNECMA-ATAR	—	—	—	—	—	—	app.15,400
Morane-Saulnier MS. 733 Alcyon	AA+AB	Potez 6D00	236	—	37′ 0.5″	30′ 7.75″	235.7	2,835	3,810
Morane-Saulnier MS. 755 Fleuret	AB	2×Turboméca Marboré II	—	2×880	31′ 7.5″	31′ 10″	193.8	4,255...4,280	5,890...6,660
Morane-Saulnier MS. 760 Paris	A+AC	2×Turboméca Marboré II	—	2×880	33′ 3.5″	32′ 10″	193.8	4,320	7,495
Payen PA. 49	X	Turboméca Palas	—	350	16′ 11″	16′ 9″	121.1	1,010	1,430
Potez 75	BA	Potez 8D32	475	—	42′ 11.75″	30′ 1″	248	3,970	5,290
Poullin JP.31 (Société de Construction d'Avions Spéciaux = SCAS)	AC	Lycoming or SNECMA 4L06	160	—	32′ 9″	18′ 10″	—	1,080	—
SIPA S. 200 Minijet	AA+AB	Turboméca Palas	—	350	26′ 3″	17′ 1.5″	—	1,060	1,810
SIPA S. 300	AA+AB	Turboméca Palas	—	350	26′ 3″	22′ 0″	104.4	1,155	1,870...2,140
SIPA S. 800	BA	SNECMA R. 105	—	app. 2,200 (+reheat)	—	—	—	—	9,260
SNCA du Nord 2501 Noratlas	C+D	2×SNECMA (Bristol) Hercules 738/758; 739/759	2×2,040	—	106′ 7.5″	72′ 0.5″	1,089.3	28,660	46,300
SNCA du Nord 2503 Noratlas	C+D	2×Pratt & Whitney R-2800-CB. 17 Double Wasp	2×2,500	—	—	—	—	—	48,500
SNCA du Nord 2600	D	2×R.-R. Dart + 2×Turboméca Palas	2×1,400	+365+ 2×350	95′ 1.75″	66′ 5″	807.3	21,770	37,480
SNCA du Nord Harpon	BA	—	—	—	—	—	—	—	—
SNCA du Nord (ex-SFECMAS) 1402 Gerfaut 1A/1B	BA	SNECMA-ATAR 101C (+ rocket)	—	2,800+	21′ 4″	27′ 10.75″	205+	—	8,800...9,900 ?
SNCA du Nord NC. 856 A Norvigie	AC	SNECMA-Régnier 4L04	145	—	39′ 6″	25′ 3″	181.3	1,490	2,535
SNCA du Nord NC. 856 N	A	SNECMA-Régnier 4L08	167	—	—	—	—	—	—
SNCA du Nord 3201	AA	Salmson 8AS04 (260 h. p.) SNECMA 4L02 (170 h. p. or Potez 6D00 (240 h. p.)	256	—	32′ 2″	26′ 2.5″	177.6	2,050	2,710
SNCA du Nord 1750 AC. 13 Norelfe	E	Turboméca Artouste I	275	—	29′ 8″	26′ 1″	698.9	1,235	1,895
SNCA du Sud-Est SE. 210 Caravelle	D	2×R.-R. Avon RA. 26	—	2×app. 10,000	112′ 6.4″	103′ 4″	1,577	42,000	up to 88,000
SNCA du Sud-Est SE. 2010 Armagnac	D	4×Pratt & Whitney R-4360 B.13 Wasp Major	4×3,500	—	160′ 7″	130′ 0″	2,540	97,580	170,850
SNCA du Sud-Est SE.5000 Baroudeur	BA	SNECMA-ATAR 101 C/101 D or more powerful versions	—	6,170...6,610	32′ 9.75″	44′ 3.5″	272.3	—	app.14,300 to 20,500
SNCA du Sud-Est Durandal	BA	Turbojet + rocket (?)	—	—	—	—	—	—	—
SNCA du Sud-Est SE.3120 Alouette I	E	Salmson 9 NH	200	—	38′ 0.75″	34′ 3.5″	1,076.4	1,650	2,750
SNCA du Sud-Est SE.3130 Alouette II	E	Turboméca Artouste II	355	—	32′ 9″	31′ 10″	—	1,710	2,980...3,310
SNCA du Sud-Est SE. 311 Hélibus	E	4 Turboméca turbine engines	4×395	—	—	—	—	—	—
SNCA du Sud-Ouest SO. 30 P Bretagne	C	2×Pratt & Whitney R-2800-CA. 18 Double Wasp (also R-2800-B. 43 of 2000 h. p. each)	2×2,440	—	88′ 2″	62′ 2″	928	30,200 to 30,865	42,990 to 44,090
SNCA du Sud-Ouest SO. 9000 Trident	BA	1×SEPR rocket engine + 2×Dassault MD. 30 Viper	—	app.11,680 total	app. 25′	—	—	—	app.11,000
SNCA du Sud-Ouest SO. 9050	BA	1×SEPR rocket engine + 2×Dassault MD. 30 Viper	—	app.11,680 total	—	—	—	—	—
SNCA du Sud-Ouest SO.4050 Vautour	B+BA+BB	2×SNECMA-ATAR 101 D/101 E. 3 (or Sapphire 6 or Avon RA. 14)	—	2×6,610 or 2×7,275	49′ 6.5″	51′ 1″	—	—	30,870 to 39,680
SNCA du Sud-Ouest SO. 1221 Djinn	E	Turboméca Palouste	236	—	32′ 9″	17′ 4.5″	340	680	1,390...1,540
SNCA du Sud-Ouest SO. 1310 Farfadet	E	Turboméca Arrius II + Turboméca Artouste II	355+355	—	36′ 9″	—	—	—	—
Wassmer Jodel D. 112	A	Continental A. 65	65	—	26′ 10.75″	20′ 6″	—	595	1,060

CLASSIFICATION: A=sports and touring; AA=elementary training; AB=advanced training; AC=special duties (communications, artillery observation, agricultural duties combat aircraft); C=transport (troops and supplies, multi-purpose); D=commercial aircraft; E=rotary-wing aircraft; X=experimental or research aircraft.

CRAFT IN 1955

PERFORMANCE					REMARKS
Max. speed m.p.h.	Mean cruise speed m.p.h.	Rate of climb ft./min.	Service ceiling ft.	Max. range miles	
150...160	136...150	—	14,700	750...800	Four-seat sports and touring high-wing monoplane. Also low-wing version.
—	—	—	—	—	Two-seat low-wing model with retractable undercarriage; under development.
200	180	—	app. 16,500	715...1,100	Multi-purpose aircraft: feeder services, freight, ambulance duties etc.
150	137	1,080	19,680	745	Four-seat sports aircraft and trainer. Complete blind flying equipment.
app. 170	app. 150	—	app. 19,700	—	4/5-seat sports and touring aircraft.
—	250	890	app. 19,700	up to 2,480	Bréguet 766 project with turboprop, also Bréguet 767, both derived from Provence.
233	202	1,460	—	up to 620	Projected 12-passenger turbine feeder aircraft; short take-off and landing distances.
—	—	—	—	—	Projected light ground attack single-seater.
—	—	—	—	—	Three-seat anti-submarine aircraft derived from B. 960; B. 965 is predecessor.
273	—	1,180	19,700	app. 4 hr.	Projected light ground attack single-seater, SNECMA R. 105, Hispano Suiza R. 800 or Turboméca Gabizos?
112	93	app. 590	11,480	370	Three-seat sports aircraft; strutted high-wing monoplane, derived from MB. 70.
—	—	—	—	—	Two-seat strutted high-wing monoplane; like MB. 100 built in small numbers.
170	145	740	16,400	app. 620	Two-seat low-wing sports aircraft, retractable tail-wheel undercarriage.
585	466	7,480	42,650+	1.2 hr.	Single-seat fighter with 4 × 20-mm cannon and rocket projectiles built in quantity and supplied to French Air Force and Indian Air Force (71).
660	528	8,460	50,000	1.3 hr.	Single-seat fighter with 2×30-mm cannon, firing radar; in production; 15 ordered by Israeli Air Force.
695	595	8,850	55,000	1.1 hr.	Heavily armed fighter and fighter-bomber; 2×30-mm cannon, rockets, guided missiles, bombs or napalm containers etc. Early IVAs with Tay, later models with Verdon. Off-shore production.
Mach 1+	—	—	app. 56,000	app. 1 hr.	200 Super Mystères to be built, with ATAR 101 G+reheat.
app. 715	—	—	—	—	All-weather two-seater with radar nose; 2×30-mm cannon and rockets; electronic target search and fire control equipment; only one aircraft built.
—	—	—	—	—	Mystère XXB is a single-seater; Mystère XXN a two-seat night fighter version of the XXB.
—	—	—	—	—	Light ground attack single-seater; can use grass runways; heavy armour plate.
—	—	—	—	—	Light single-seat delta-wing interceptor; prototype. Very high rate of climb.
90	75	490	—	2.5 hr.	Single-seat open low-wing monoplane.
100	70...80	—	—	—	Two-seat development of the Turbulent; foreign interest.
127	—	—	18,000	3 hr.	Two-seater for training and artillery observation.
168	150	—	—	3.5 hr.	Derived from Monitor I; all-metal wing unit.
150	130	1,180	18,000	620	As predecessor, but with different power plant.
454	404	3,350	40,000+	745	In production for French Air Force. Prototypes of a Navy version (170-M) ordered; released for export.
220	196	1,340	19,700	1,020	Three-seat experimental aircraft; aerodynamic gust compensation.
170	150	1,180	19,700	745	Military and civilian versions in production (MH. 1521-M); 6-seat transport, ambulance, freight etc.
210	app. 170	835	21,650	1,250	Commercial transport for max. 44 passengers. — HD. 34 for aerial survey; — HD. 35/HD. 36 for anti-submarine operations.
—	app. 180	975	app. 21,500	1,480	Passenger and freight aircraft (44 passengers). — Produced and sold by S.N.C.A.S.E.
—	455	—	33,000	1,550...1,850	Projected jet transport for 80/84 passengers.
—	300	—	28,000	up to 1,550	Projected feeder airliner for 28 to 36 passengers. Max. 48 passengers; also pure freight version.
650	—	39,400	app. 65,000	15 mins. to 1 hr.	Experimental ramjet aircraft. — Predecessors 010 and 016; Marboré for take-off. For high-speed research at 33,000 to 65,000 ft.
Mach 2	—	in 5 mins. to 25,000 ft.	—	—	First 022 to fly end of summer 1955. Swept wing; longer than 021.
162	150	786	15,100	620	Two-to-three-seat trainer; in production. — MS. 735 with 310 h. p. Potez 6 D 30; prototype.
440	—	3,350	40,000	780	Two-seater fighter trainer, also in ground attack version, for carrier-borne operations or as communications aircraft.
405	348	2,260	32,800	780+	Four-seat communications and touring version of MS. 755 Fleuret.
310	217	1,140	27,900	280	Single-seat delta-wing experimental aircraft; PA. 56 Jockey with one Viper or two Marborés in development.
171	140	1,570	—	435	Two-seater for ground support and anti-tank operations.
112	80	—	—	—	Agricultural aircraft; small number built.
250+	217	885	26,250	435	Two-seat trainer; five pre-production models ordered.
224	194	985	19,700	1.3...2 hrs.	Two-seat trainer and communications aircraft.
Mach 1	—	13,800	—	1.3 hrs.	Project for a light ground attack single-seater; 1 or 2×30-mm cannon and 30 rocket projectiles.
273	210	1,230	24,600	1,550	Military or civilian transport; large-scale production. Turboméca Marborés fitted experimentally in wing tips.
—	—	—	—	—	Projected passenger or freight version of Nord 2501.
—	295	—	—	310...930	Project under programme for twin-turboprop commercial transport; 40 passengers.
Mach 1+	—	—	—	—	Project for a light-weight fighter.
Mach 1.3+	—	—	—	—	Single-seat light interceptor with delta-wing; pre-production batch under construction.
118	106	984	16,400	124	Two-to-three-seat artillery observation post; in production. Also communications and ambulance duties. Float version NC. 856 H.
—	112	786	—	360	Civil version of NC. 856 A; four-seat.
170	158	1,240	17,000	470	Two-seat trainer (tandem); version with SNECMA 4L02 to be built for training artillery observation crews.
78...93	—	1,000...1,570	app. 13,000	—	Helicopter for 1 to 3 persons; licence agreement with Aerotécnica, Spain.
—	455	—	app. 42,600	1,550...2,300	Twin-jet medium-stage commercial transport for 70/91 passengers; 2 prototypes, the first scheduled for flight tests end of May.
330	280	—	20,000+	3,100+	Four-engined long-range commercial transport for 84 to 107 passengers or freight.
Mach 1+	—	app. 9,850 to 11,800	app. 50,000	—	Single-seat ground attack aircraft and fighter which takes off from a trolley and lands on retractable skids; 2×30-mm cannon and rockets. — Version 2 is lighter.
Mach 1+	—	—	—	—	Light delta-wing interceptor; prototype under construction.
78	60	890	11,800 to 13,000	140	Two-to-three-seat multi-purpose helicopter.
112	106	1,180	14,760	up to 190	Turbine version of Alouette I.
—	140	—	—	—	Projected commercial helicopter for 20/30 passengers or freight.
300	258	984	26,250	1,550	Commercial transport for 30/43 passengers; SO. 30 Nene and SO. 30 ATAR experimental models; experimental installation of two Turboméca Palas auxiliary engines.
Mach 1,5+	—	—	—	—	Single-seat interceptor; prototype of SO. 9050 day fighter.
Mach 1.5+	—	—	—	—	Two pre-production models under construction.
720	—	9,850	52,500	up to 3,100	Ground attack aircraft, all-weather fighter, bomber or reconnaissance aircraft; 2×30 or 37-mm cannon, rockets, guided missiles, bombs. In production.
90	62	—	up to 16,400	up to 155	Two-seat civil or military helicopter for large-scale production.
—	150	—	—	—	Four-seat experimental compound helicopter; SO. 1330 project derived from Farfadet (convertible aircraft?).
124	100	690	16,000	370	Two-seat sports aircraft, small number being built.

etc.); B = combat aircraft (day fighter, all-weather fighter, fighter-bomber); BA = combat aircraft (interceptor or ground attack aircraft); BB = combat aircraft (bomber or naval



Dassault *Super Mystère IV B. I.*

doubt in the front ranks. A substantial contribution to this success has been made by *Société Turboméca's* small turbine engines. It was their availability that enabled jet trainers of the *Morane-Saulnier MS. 755 Fleuret, Fouga CM.170-R Magister* and *SIPA S.200 Minijet* and *S.300* class to be brought out at short intervals. Today the *Magister* is in production for the French Air Force, and in November 1954 the training committee of N.A.T.O.'s Military Agency for Standardization recommended this twin-jet Fouga trainer as standard equipment for basic and advanced training in other N.A.T.O. countries. Although each European N.A.T.O. country is responsible, under the agreements, for its own flying training, Fouga recently announced that the *Magister* or licences for its production may now be sold abroad.

Nine CM.170-Rs were undergoing flight testing at the end of March 1955. Preparations for quantity production, to be handled in cooperation with S.N.C.A. du Sud-Est and Morane-Saulnier, should be completed by the late summer, when a monthly output of six production models is planned.

Structural details of the *Magister* were given in *Interavia* No. 1, 1955. Meanwhile, the French Naval Air Service is also considering the purchase of trainers of this type. Two CM.170-Ms have been ordered for Naval testing, particularly of take-off and landing performance on aircraft carriers.

Morane-Saulnier has a full measure of work on its hands with production of the *Magister* and construction of a substantial number of *MS.733 Alcyons* of its own design. The experience gained on the *Fleuret* jet trainer is being applied to a number of projects. For example, a four-seat version—MS.760—designed as a high-speed communications aircraft has already begun flight tests and is to be built under licence by Beech in the United States; in addition the *Fleuret* is being offered, in particular on the foreign market, as a single-seat ground attack aircraft, as a trainer for carrier operations and for training in photographic reconnaissance.

*

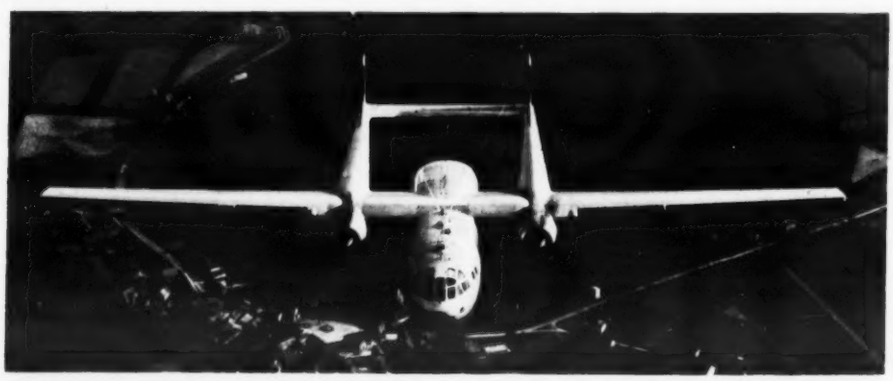
Production aircraft need production engines

What is true of airframe development applies even more strongly to engines: design, prototype construction, testing and the preparation of quantity production take years.

H. Desbruères, Chairman of the Board and Managing Director of the Government *Société Nationale d'Etude et de Construction de Moteurs d'Aviation,* told the General Meeting on March 30th that it had taken five years of concentrated work and systematic planning to get the *SNECMA-ATAR 101* axial-compressor turbojet to the production stage. Today one version, the ATAR 101D of approx. 6,600 lbs. take-off static thrust, is in production, and considerable efforts are being made to speed up preparations for quantity production of more powerful versions (for example, ATAR 101 E.3 of 7,700 lbs. s.t. and 101 G of 9,250 lbs. s.t. with reheat). Desbruères stressed that a long-term production programme and closest cooperation with the airframe manufacturers are essential if France is to hold her own against foreign competition in jet engine production (in particular of high-power engines).

At any rate S.N.E.C.M.A.'s systematic efforts have not been unsuccessful. Overseas airframe manufacturers are showing keen interest in the ATAR series, and the ATAR's surprisingly simple successor, the *SNECMA Vulcain,* should also attract attention when it is ready, since it weighs only about 3,300 lbs. for a take-off static thrust of approx. 13,200 lbs. The ATAR's strikingly compact arrangement of accessories has been used again, so that the *Vulcain's* overall diameter has been kept down to 45.7 ins. The *Vulcain* is not yet in production, but it should be able to follow the ATAR on the production line without extensive retooling.

Space limitations preclude discussion of the ATAR's different versions. Suffice it to say that the ATAR series is a prime example of "evolutionary" development. In the transition



More than 70 *Nord 2501 Noratlas* twin-engined transports (SNECMA - Bristol *Hercules* engines) have been delivered so far. A version with Pratt & Whitney engines is projected.

High operating economy and exceptional flying and transport performance are the chief characteristics of the *Hurel-Dubois HD. 32.*

A pure French design from nose boom to tail: S.N.C.A. du Sud-Ouest's versatile SO. 4050 *Vautour* combat aircraft.

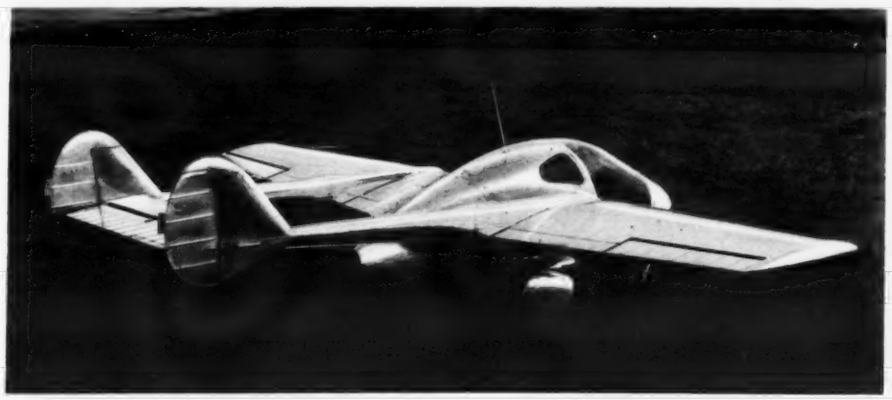
from one version to the next, more powerful, version care was always taken to ensure that modifications did not exceed a reasonable measure.

Although S.N.E.C.M.A. has for a good many years concentrated most of its development and production capacity on jet engines—and is developing them for vertical take-off aircraft as a side-line (cf. No. 1, 1955 on coleopters)—a tour of its workshops shows that the piston engine is not entirely neglected. As is known, the 14-cylinder Bristol *Hercules* sleeve-valve engine is being produced under licence for the *Noratlas* transport, and several versions of the 4-cylinder *S.N.E.C.M.A. 4 L*, for 145 to 167 h.p., and the 12-cylinder *S.N.E.C.M.A. 12 S* are still being built.

S.N.E.C.M.A.'s efforts in the field of jet deflection devices for production turbojets are directed towards reducing thrust losses. Evidence of the technical quality of the S.N.E.C.M.A. jet deflection system is the fact that Aerojet General Corp. of Azusa, California—known for its JATO take-off aids—has acquired sole production and sales rights in the United States.

While S.N.E.C.M.A. has concentrated on the axial compressor ever since the beginning of turbojet development, Société Hispano Suiza at first specialized in radial-compressor engines. So that it could begin production as soon as possible, the company acquired licence rights to the *Nene* in 1946, and the *Tay* later. Having succeeded in raising considerably the *Nene's* power (from 5,000 to 6,000 lbs. s.t.), similar structural and material refinements were also made to the *Tay*. The latter engine—of which more than 200 have been delivered—was developed into the *Hispano Suiza Verdon*, said to deliver a thrust of 7,700 lbs. and as much as 10,000 lbs. with reheat. Despite this substantial increase in thrust, the *Verdon* is interchangeable with the *Tay 250*, a fact much appreciated by the French Air Force maintenance services. Both engines have the same overall diameter, and differences are limited to thermo-dynamic and flow improvements: internal refinements have enabled an increase to be made in air mass flow, turbine efficiency and permissible mean temperature behind the turbine rotor. Chief structural modifications, in addition to the necessary adaptation of the fuel system, are: lengthening of the air ducts to the combustion chambers, improvement in the shape of the air intake to the compressor to provide the needed increase in air quantity, adaptation of the

Fouga CM. 170-R Magister two-seat jet trainers, in production for the French Air Force. – Other versions are the CM. 170-M for carrier-based operations, CM-160 of simpler structure and less extensive equipment for basic training, CM. 195 with modified wing unit and more powerful engines for conversion training to high-speed combat aircraft.



SIPA S. 200 Minijet, an ultra-light two-seat trainer

SIPA S. 300, jet trainer with two seats in tandem.

Morane-Saulnier has designed several forms of the MS. 755 *Fleuret* jet trainer. A high-speed four-seat version, the *MS. 760 Paris*, is to be built under licence by Beech Aircraft Corp. in the United States.

FRENCH PISTON ENGINES...

MAKER AND TYPE	No. of cylinders	POWER				MAIN DIMENSIONS				DRY WEIGHT	CONSUMPTION at max. contin. power
		Take-off power h.p.	at r.p.m.	Max. contin. power h.p.	at r.p.m.	Length ins.	Width × height or diameter ins.	Bore × stroke ins.	Swept volume cu. ins.	lbs.	lbs./h.p.h.
Hispano Suiza 12 Z 17	12	1,475	2,400	—	—	95	29.1×39.4	5.9×6.7	2,197	1,520	—
Lutétia 4 C 02	4	44	2,800	35	2,600	—	—	2.9×2.8	77.5	101	—
Lutétia 6 A 01	6	80	3,000	70	2,600	37.1	19.7 ×19.7	2.4×2.4	123.9	132	—
Minié 4 DC 32	4	80	2,610	75	2,575	31.1	33.9 ×16.9	3.9×3.6	181.9	190	—
Minié 4 DF 28	4	—	—	65	2,450	29.3	32.9 ×17.75	3.9×3.6	181.9	196	0.50
Potez 4 D 01	4	158	2,520	153	2,500	47.5	20.1 ×26.3	4.9×4.7	357.0	316	0.47
Potez 4 D 31	4	218	2,600	197 (rated power)	2,500	47.5	20.75×28.4	4.9×4.7	357.0	366	0.50
Potez 6 D 00 (6 D 02)	6	236	2,530	228 (rated power)	2,500	61	20.1 ×26.3	4.9×4.7	539	484 (517)	0.49
Potez 6 D 30	6	300	2,400	256 (rated power)	2,400	61	20.1 ×28	4.9×4.7	539	570	0.51
Potez 8 D 30 (8 D 32)	8	445 (475)	2,800	395 (rated power)	2,700	67.75	31.3 ×31.6	4.9×4.7	713.9	740	0.59
Salmson 4 AH	4	100	—	—	—	—	—	—	—	—	—
Salmson 6 AH	6	143	—	—	—	—	—	—	—	—	—
Salmson 5 AQ 01	5	90	2,550	80 (rated power)	2,440	27.9	29.5	3.9×3.9	240.0	appr. 220	—
Salmson 7 AQ 03	7	148	3,100	128 (rated power)	3,000	44.9	32.7	3.9×3.9	335.6	appr. 310	0.55
Salmson 9 ABC	9	256	1,780	227 (rated power)	1,700	—	—	4.9×6.7	1,141.2	appr. 595	—
Salmson 9 ADB	9	59	2,350	45	2,200	27.3	appr. 26	2.8×3.4	181.9	appr. 175	—
Salmson 9 ND	9	192	2,130	172 (rated power)	2,050	—	—	3.9×5.5	604.1	375	—
Salmson 9 NH 02	9	217	2,250	182 (rated power)	2,130	—	—	—	—	—	—
Salmson 8 AS 04. A	8	256	—	—	—	—	—	—	—	—	—
SNECMA 4 L 00	4	145	2,340	133	2,280	53.9	19.7 ×29.9	4.7×5.5	386.3	342	—
SNECMA 4 L 02	4	167	2,500	167	2,500	53.9	19.7 ×29.9	4.7×5.5	386.3	350	—
SNECMA 4 L 04	4	145	2,340	133	2,280	53.9	19.7 ×29.9	4.7×5.5	386.3	342	—
SNECMA 4 L 06	4	167	2,500	167	2,500	53.9	19.7 ×29.9	4.7×5.5	386.3	appr. 350	—
SNECMA 4 L 08	4	158	2,500	142	2,415	53.9	19.7 ×29.9	4.7×5.5	386.3	appr. 340	—
SNECMA 12 S 02	12	570	3,300	435	3,250	63.8	27.6 ×38.9	4.1×4.5	732.3	appr. 815	0 50
SNECMA 14 X 02	14	810/840	3,100	670/700	2,850	63.9	39.6	5.5×4.6	1,159.5	1,310/1,630	0.64
SNECMA 14 X 04	14	810/840	3,100	680/700 (?)	2,850	63.9	39.6	5.5×4.6	1,159.5	1,310	0.68
SNECMA 14 X H	14	810	2,700	670	2,650	—	39.6	5.5×4.6	1,159.5	1,190	0.73
SNECMA (Bristol) Hercules 758	14	2,040	2,800	1,670	2,500	63.0	51.9	5.75×6.5	2,360	2,140	appr. 0.42

...AND TURBINE ENGINES

MAKER AND TYPE	Category	Take-off power h.p. or lbs.	at r.p.m.	STRUCTURE Compressor	Combustion chambers	Turbine	MAIN DIMENSIONS Length ins.	Max. diameter or width × height ins.	Dry weight lbs.	Spec. consumption at max. contin. power lbs./lbt.h
Dassault MD. 30 Viper (+ reheat)	Jet	appr. 2,200 with reheat	—	Axial 7-stage	Annular	1-stage	—	appr. 27.5	appr. 620	—
Hispano Suiza Nene 105 (Nene 105 AR + reheat)	Jet	5,950 (appr. 6,840)	12,500 (12,500)	Radial 1-stage	9	1-stage	96.9 —	49.6 —	1,610 (appr. 2,200)	appr. 1.1 (appr. 2.0)
Hispano Suiza Tay 250 A (Tay + reheat)	Jet	6,840 (8,380+)	11,000	Radial 1-stage	9	1-stage	99.6	50.0	appr. 2,000	1.10
Hispano Suiza Verdon (Verdon + reheat)	Jet	7,720+ (9,920+)	11,100 (11,100)	Radial 1-stage	9	1-stage	99.6 —	50.0 —	2,020 (2,800)	1.07 —
Hispano Suiza Avon RA. 7	Jet	7,495+	7,950	Axial	—	—	appr. 102	appr. 43	appr. 2,470	appr. 0.9
Hispano Suiza R. 800	Jet	appr. 2,200	—	Axial	—	—	—	—	—	—
SNECMA-ATAR 101 C	Jet	6,170	8,500	Axial 7-stage	Annular 20 burners	1-stage	112.0	34.9	2,070	1.04
SNECMA-ATAR 101 D	Jet	6,610	—	Axial 7-stage	Annular 20 burners	1-stage	140.95	36.2	2,120	1.04
SNECMA-ATAR 101 E (101 E. 3)	Jet	7,275 (7,720+)	—	—	—	—	—	—	—	—
SNECMA-ATAR 101 F (+ reheat)	Jet	8,380	Version 101 D with afterburner: no production planned; used only as development engine for ATAR 101 G.							
SNECMA-ATAR 101 G (+ reheat)	Jet	9,260+	—	—	—	—	—	—	—	—
SNECMA Vulcain (with reheat)	Jet	13,230	—	Axial	Annular	1-stage	—	45.7	appr. 3,090	—
SNECMA R. 105	Jet	appr. 2,200	—	Axial	—	—	—	—	—	—
Turboméca Piméné	Jet	240	36,000	Radial	Annular	1-stage	41.6	15.9	119	1.06
Turboméca Palas	Jet	350	appr. 33,500	Radial	Annular	1-stage	41.6	15.9	appr. 155	appr. 1.15
Turboméca Marboré I/II	Jet	840 (880)	23,000 (22,600)	Radial	Annular	1-stage	43.3	22.3	265 (298)	appr. 1.10
Turboméca Aspin I/II	Turbo-prop	485 (795)	appr. 35,000	Axial (by-pass)	Annular	2-stage	63.6	appr. 26	appr. 310	0.52 (0.57)
Turboméca Marcadeau (Combination Artouste II + reduction gear for propeller)	Turbo-prop	395 h.p. + appr. 75 lbt.	2,500	—	—	—	54.7	17.7×21.4	306	—
Turboméca Gabizos	Jet	2,425	—	—	—	—	—	—	560	—
Ramjet engines:										
SFECMAS (SNCAN) S. 600	Ramjet	1,320 lbt at 620 m.p.h. at sea level			—	—	127.9	23.6	160	1.9 lbs./sec.
SFECMAS (SNCAN) S. 900	Ramjet	2,510 lbt at 620 m.p.h. at sea level			—	—	162.4	35.4	110	4.0 lbs./sec.
Pulse-jet engines:										
SNECMA Escopette	Pulse-jet	22 lbt near ground	—	—	—	—	113.4	6.2	10.6	1.8 lbs./lbt.h
SNECMA Ecrevisse A	Pulse-jet	44 lbt near ground	—	—	—	—	60.6	—	13.2	2.2 lbs./lbt.h
SNECMA Ecrevisse B	Pulse-jet	66 lbt near ground	—	—	—	—	97.6	—	22.0	1.35 lbs./lbt.h

Société A.B.G., Aries, La Bougie B.G. & Sfeder Réunies:
Ignition systems for piston engines and turbojets; machine tools; compressors.

Aérazur, Constructions Aéronautiques:
G-suits, life jackets, crash helmets, oxygen masks and parachutes, rubber dinghies and brake parachutes.

Aérocessoires Simmonds:
"Nylstop" safety nuts for high heat stresses.

Air-Equipement S.A.:
Voltage regulators, "Duplex" ignition systems for turbojets *(Viper)*, starters for piston engines and turbojets, particularly for low-power turbojets (Turboméca *Gabizos*, Hispano Suiza R. 800 etc.), autosyns, pressure gauges for lubricant and hydraulic systems, aircraft medical oxygen systems, valves, switches, pumps, regulators and air compressors, fuel metering equipment for turbojets, D.C. generators, de-icing equipment, navigation instruments, undercarriage parts etc. Off-shore orders and production for Republic Aviation Corp.: Lucas, Rotax and Bendix licences.

Airindex, Etablissements:
Equipment for engine control and supervision.

A.M.A., Société des Etablissements:
Engine controls, lubricant, coolant and fuel systems, filters, air conditioning plant, aircraft instruments.

Andyar, Société pour l'Exploitation des Procédés et Brevets H. André & M. Yardney:
Light-weight silver zinc accumulators (very low acid content, used for starting high-power turbojets).

Appareillage Aéronautique:
Flight and navigation instruments.

Applications du Roulement:
Ball and roller bearings for controls etc.

Ateliers et Chantiers de la Loire:
Large stretch presses for the aircraft industry.

Auxilec, Auxiliaires Electromécaniques de Précision:
Aircraft electric motors, transformer groups etc.

Aviac, Société des Etablissements:
Electrical and mechanical remote controls, light metal rivets.

Avialex, Société:
Burners for de-icing and air conditioning systems, test beds for turbojets, sheet metal work.

Aviorex:
Parachutes, rubber dinghies and accessories.

B.B.T., Etablissements Barbier, Bernard & Turenne:
Lighting installations for civil and military airfields (to I.C.A.O. recommendations), optical equipment, aircraft instruments (magnetic compasses, drift meters etc.).

Beaudouin, Ateliers de Construction:
Recording cameras type A. 11, A. 12 and A. 15, measuring instruments.

Bergougnan, Société Générale des Etablissements:
Aircraft tyres.

Blanc & Cie S.A., Etablissements Achille:
Special steel bolts of all kinds, metal-working.

Boet & Cie:
Silencing of test benches for turbojets and piston engines, silencing of runways.

Bréguet:
Precision time measurers for aeronautical and marine use.

Brion, Leroux & Co.:
Electrical measuring instruments, small D.C. motors, switches, warning lamps.

Bronzavia:
Engine accessories (carburettors, injection pumps, filters, fuel feed pumps, regulators, starters), pneumatic and electrical equipment for all purposes (electric motors, voltage converters, pressurization and air conditioning plant, etc.), aircraft VHF equipment, LF receivers, intercom., VHF and HF ground stations, reflex and gyro gun sights and camera guns for fighters, bomb sights.

Cégédur, Compagnie Générale du Duralumin et du Cuivre:
Semi-finished parts of non-ferrous metals and high-resistance light metal with or without heat treatment, heavy metal working, sheets and profiles of variable thickness, special alloys for forged and stamped parts, cables, wires.

Cellolac S.A., Etablissements:
Paints and varnishes, protective coatings.

Champion, Société de Construction de Machines Electriques et Pneumatiques:
Pneumatic machine tools and accessories.

Chausson, S.A. des Usines:
Oil and water coolers, heat exchangers, temperature regulators, heating apparatus, fuel tanks.

C.I.M.A., Compagnie Industrielle de Matériel d'Aviation:
Flexible hose, protective covers for fuel tanks, flexible fuel tanks.

C.S.F., Compagnie Générale de Télégraphie sans Fil:
Communications equipment, navigation, radar equipment etc., cf. S.F.R.

Dassault, Avions Marcel:
Afterburners for turbojets, sale of Lear autopilots.

Delord, Société:
Electrical and mechanical equipment for engine supervision (piston engines and turbojets), indicators for aircraft systems, hoisting tackle.

Derveaux, Laboratoires R.:
Electronic computers, electronic bomb sights, etc.

D.O.P., Dispositifs Oléo-Pneumatiques:
Undercarriages and undercarriage parts, shock absorbers, wheel brakes, hydraulic aircraft equipment.

Dunlop, S.A. des Pneumatiques:
Tyres, wheels, brakes.

E.C.A., Etudes et Constructions Aéronautiques:
Stabilization and measuring gyros, distant-reading compasses, autopilots, sights, servo motors and servo controls for guided missiles, flap-operated control surfaces, electrical controls, guided missiles.

E.C.E., L'Equipement et la Construction Electrique:
Electrical indicators, circuit breakers, electrical warning systems, servo controls.

E.F.A., Etudes et Fabrications Aéronautiques:
Parachutes for crews, troops and cargo, G-suits, safety belts.

E.R.S.:
Magnetic stoppers for accumulators.

E.S.P.A., Equipements Spéciaux pour l'Aviation:
Flexible hose, tube connections for all kinds of fluids, light-weight air tubing for air conditioning systems.

E.T.N., Etudes et Techniques Nouvelles:
Hydraulic jacks, winches, scaffolding, hoists, lifting trolleys, slings.

Facine, Société:
Cameras and camera guns.

Faure Herman, Etablissements:
Consumption gauges for fuel metering, electrical revs. counters.

Fenwick, S.A.:
Tools and machine tools, agents for "Titeflex" flexible metal tubes.

Filotex, Etablissements:
Special cables for aircraft production, multiple cables, co-axial cables etc.

Genin & Cie, S.A. Pierre:
Sale of "Textiglass" glass fibre plastics, plastic insulating material.

Gerzat, Société Métallurgique:
Light metal bottles for compressed gases and liquids of all kinds, light metal tubes, etc.

Guiot S.A., Etablissements L.:
Pumps for all purposes.

H.B., Etablissements:
Tubing for all kinds of fluids and max. pressures, special rubber connecting pieces for extreme temperatures.

Hélices Ratier:
Regulators and remote controls, electrical and hydraulic equipment.

Hispano Suiza, Société d'Exploitation des Matériels:
Undercarriages (tandem landing gear for SO. 4050 *Vautour*), aluminium castings.

Intertechnique:
Fuel gauges, electronic equipment.

Jacottet, S.A. des Etablissements Paul:
Remote controls, particularly power-boosted controls for high-speed aircraft (irreversible, with hydraulic "feel"; Leduc licences); automatic stabilizers (S.N.C.A.S.O. licence).

Jaeger, S.A. des Etablissements Edmond:
Mechanical and electrical revs. counters, altimeters, accelerometers, gyro equipment.

Kléber-Colombes:
Tyres, pneumatic de-icers for wing and tailplane leading edges and propellers, pneumatic packing for pressure cabins, "Klégécell" light-weight structural material.

Labinal, Etablissements:
Aircraft generators, voltage regulators, electrical switches etc.

(continued on p. 405)

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discriminating travelers to enjoy the unique combination of speed and quiet in its new Super Constellations, the largest, roomiest airliners in the world today.

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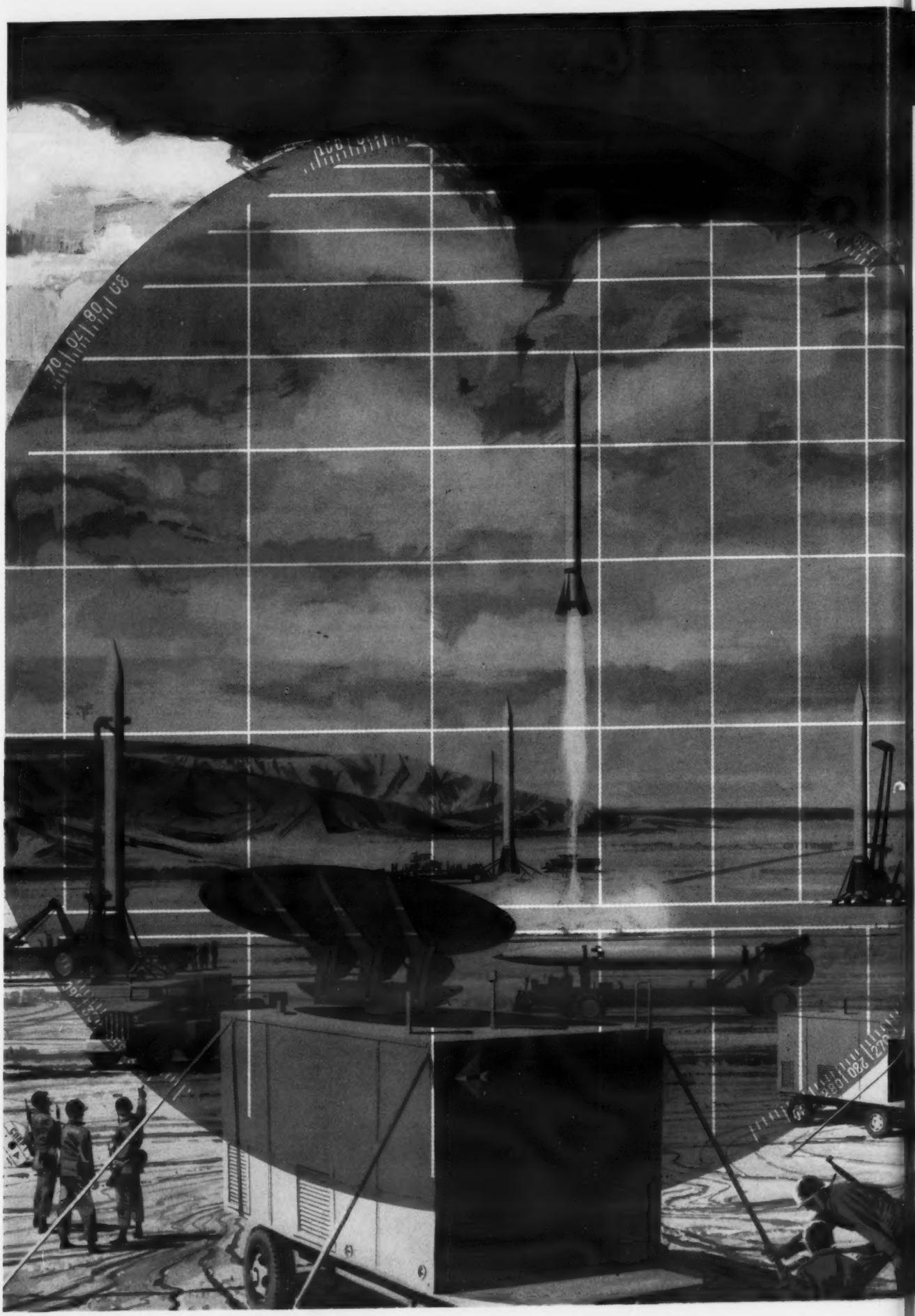

GUIDING THE "CORPORAL"

ELECTRONIC GUIDANCE IS THE SECRET OF THE CORPORAL'S ACCURACY

The U. S. Army required a ground-to-ground missile capable of delivering an atomic warhead at supersonic speed — accurately–to a target beyond the range of artillery. Army Ordnance awarded four prime contracts for this project:

PRIME CONTRACT–RESEARCH
Jet Propulsion Laboratory, California Institute of Technology
Basic research and development covering all facets of total problem.

PRIME CONTRACT–DEVELOPMENT
Gilfillan Bros., Inc.
Improvement, simplification of ground and airborne electronic equipment.

PRIME CONTRACT–PRODUCTION: MISSILE
Firestone Tire & Rubber Co.
Missile and missile handling equipments.

PRIME CONTRACT–PRODUCTION: GROUND GUIDANCE SYSTEM
Gilfillan Bros., Inc.
Complete ground guidance system.

RESULT: ***The Army's "Corporal," ground and airborne equipment. In full production; delivery being made to troops.***

Today's missiles are superior to yesterday's mechanically timed rockets for one reason—electronic *guidance.*

It is electronics research and the electronics industry that put the guidance into the guided missiles . . . that share the major responsibility of keeping America first in guided missiles.

Primary credit for the "Corporal" is due to the basic research achievements of the engineers and scientists of the Jet Propulsion Laboratory at the California Institute of Technology. Gilfillan is proud to have been awarded a prime contract to assist in the development and do the production of the vital electronic guidance system.

In the electronics industry, Gilfillan is a recognized leader. Gilfillan's ability to carry on from basic research comprehensively—to approach a total problem as a whole and achieve a whole solution—has been thoroughly proven in GCA Radar, the "Corporal" guidance system, and is now being further demonstrated in top secret projects in a number of fields.

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GCA
AROUND THE WORLD

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AN A.B.C. OF THE FRENCH ACCESSORIES AND EQUIPMENT INDUSTRY

(continued from p. 400)

L.C.T., Laboratoire Central de Télécommunications:
Communications equipment, navigation aids, radar and electronic equipment.

L.M.T., Le Matériel Téléphonique:
Radio equipment of all kinds for all wave bands, D/F equipment, instrument flying trainer, remote control equipment.

Magnésium, Société Générale du:
Ultra-light magnesium alloys.

Magnétos R. B., Société des:
Single and double magnetos, starters for turbojets, test equipment.

Manufacture Metallurgique de la Jonchère:
"Avioflex" and "Boa-Inox" flexible tubes for all kinds of fluids and high differential pressures.

Marston:
"Flexelite" flexible tanks for fuels of all kinds, radomes, aerial mountings, tailplane caps, tubing (Marston Excelsior Ltd. licences).

M.A.T.R.A., Société Générale de Mécanique — Aviation — Traction:
Design and construction of special aircraft, guided missiles; rocket launchers, aircraft armament.

Messier S.A.:
Design and production of undercarriages of all sizes, hydraulic and electro-hydraulic systems for aircraft and test beds, wheels and wheel brakes for aircraft and their hydraulic controls, "Ministop" brake pressure regulator, electronics.

Microfiltres A.E.F.:
Micro-filters for ground and aircraft installations and for fuel trucks, equipment for handling and cleaning fluids.

O.M.E.R.A., Société d'Optique, de Mécanique, d'Electricité et de Radio:
Electronic, optical and mechanical equipment, SARAM 5-52 aircraft VHF transmitter-receiver, UHF equipment, radar equipment, SEPHOT 20 camera gun and SEPHOT 10/11 cameras.

Paris-Rhône, Société de Paris & du Rhône:
Aircraft generators, plastics, castings etc.

Potez, Société des Avions Henry:
Portable and jettisonable current generators.

Précilec S.A.:
Small electric motors for servo controls, remote-reading indicators.

Produits Chimiques du Moulin:
"Divolic" bonding fluid and "Divopat" bonding paste for packings etc.

Radio-Air, S.A. des Applications Industrielles Radioélectriques:
Aircraft transmitter-receivers, radio compasses, electrical remote control installations.

Radio-Industrie S.A.:
Television and radar, communications equipment.

Ragonot, Etablissements E.:
Generators, electric motors, transformers, remote-reading indicators.

Rellumit, Etablissements Muller:
Micro-filters for fuels and lubricants, stationary and mobile fuelling installations, quick fuelling equipment, tube connections, flexible hose.

Rochar:
Frequency measurers and precision revs. counters, electronic counters.

Rubanox:
Radiators, exhaust manifolds, jet pipes for turbine engines, sheet metal parts.

Sadir-Carpentier S.A.:
Radio and radar equipment, airport equipment, gyroscopes, aircraft sights and fire control equipment, electric motors and electrical measuring equipment.

S.A.F.T., Société des Accumulateurs Fixes et de Traction:
"Voltabloc" aircraft batteries (no maintenance).

S.A.M.M., Société d'Applications des Machines Motrices:
Equipment for high-pressure hydraulic systems; servo controls, wheels, undercarriages and shock absorbers, gun mountings, hydraulically operated rotating gun turrets, equipment for firing training.

S.A.R.A.M., Société d'Applications Radioélectriques à l'Aéronautique et la Marine:
VHF transmitter-receivers for aircraft or ground use, UHF transmitters and receivers.

S.A.R.M.A., S.A. de Recherches de Mécanique Appliquée:
Control systems for civil and military aircraft.

S.A.T.A.M., S.A. pour tous Appareillages Mécaniques:
Equipment for fuel trucks, airport equipment of all kinds.

Sciaky S.A.:
Welding machines, electronic control systems.

Scintex S.A.:
Magnetos, electrical plugs, electronic equipment for checking firing sequence.

S.E.C.A.N., Société d'Etudes et de Constructions Aéro-Navales:
Production and sale of Lockheed "Speedpak" jettisonable containers, jet pipes for turbojets, radar aerials.

S.E.M.C.A., Ateliers:
Pressure regulators, turbo-cooling blowers, auxiliary drives, thermal de-icers, starters for turbojets, etc.

S.E.P.R., Société d'Etude de la Propulsion par Réaction:
Rocket motors and accessories.

S.F.E.N.A., Société Française d'Equipements pour la Navigation Aérienne:
Gyroscopes and magnetic compasses, complete navigation equipment, automatic pilots and controls for guided missiles, remote controls, transmitters and receivers, light VHF R/T equipment.

S.F.I.M., Société de Fabrication d'Instruments de Mesure:
Flight testing equipment.

S.F.O.M., Société Française d'Optique et de Mécanique:
Aerial cameras and lens systems, sights and navigation instruments, photographic equipment.

S.I.N.T.R.A., Société Industrielle des Nouvelles Techniques Radioélectriques:
Test equipment, aircraft radio equipment.

Socapex-Ponsot S.A.:
Radio helmets, microphones etc.

S.F.R., Société Française Radioélectrique:
Radio navaids, radio altimeters, radio compasses, A.S.V. 23 instrument landing equipment, Decca Navigators with Flight Log, aircraft radar, fire control equipment, collision warning radar, ground radar stations (fixed or mobile) for air traffic and approach control, also for fighter control, field radar equipment with tent (built up of 110-lbs. elements), Klystron tubes, industrial application of electronics.

S.G.E., Société Générale d'Equipements pour l'Automobile, la Locomotion Aérienne et toutes Applications spéciales de l'Electricité:
Electrical circuit breakers, position lights, aircraft lighting cables and leads, electric motors, test apparatus for electrical equipment etc.

Sofrance S.A.:
Petrol and kerosene filters for all purposes, water excluders.

Souriau & Cie:
Plugs (weather-tight) and switches.

S.N.C.A.S.O., Société Nationale de Constructions Aéronautiques du Sud-Ouest:
Ejection seats, plastic honeycomb materials, metal bonding process.

S.T.E.R.A., Société d'Equipement Radio Aéronautique:
Design of radio-electric installations; airborne and ground electronic installations.

Superflexit S.A.:
Flexible hose, flexible fuel tanks.

Técalémit S.A.:
Cabin cooling and heating equipment, fuel and lubricant distributors, pipes for high-pressure hydraulic systems.

Téléflex, Dept. de Tiss-Metal Lionel-Dupont & Cie:
High precision mechanical controls.

Thomson-Houston, Compagnie Française:
Radio communications equipment, radar for traffic control, surveillance radar and precision approach radar, fixed transponders for military navigation, transportable transmitter-receivers, GCA trainers with daylight screens, gas discharge tubes.

Triplex, Société du Verre:
Safety glass in all forms, armoured glass etc., protective goggles.

T.R.T., Télécommunications Radioélectriques et Téléphoniques:
Mobile transmitter stations, airport equipment, television and telephone installations.

Turck, Etablissements Jean:
Remote control and measuring equipment, radio command controls, data transmission systems, infra-red detectors and transmitters (infra-red homing heads).

Ulmer & Cie, Etablissements L.:
Oxygen masks, retractable and fixed landing floodlights, signalling lamps for aircraft and airport use, airport lighting.

Vibrachoc:
Racks and shock absorbers (Robinson Aviation licence).

Zénith S.A., Société du Carburateur:
Carburettors, filters, regulators, engine starters, pumps.

Zivy & Cie: Test and counting equipment, micrometers, revs. counters.

Zodiac, Société: Pneumatic equipment of all kinds.

jet pipe to the increased air flow.—The *Verdon*, now in production, has probably reached the practical power limit for a radial-compressor engine. The *H.S.-R.450 afterburner* for this engine is now so far advanced that there are no obstacles to its utilization in quantity. Hispano has since taken the logical step forward by obtaining licence rights for the *Avon* and is now preparing for production of this axial-compressor engine.

It is not possible to give details here of the considerable number of medium and low-power piston engines in quantity production at such firms as *Société des Moteurs Salmson* and *Société des Avions et Moteurs Henry Potez*. Data on these and other designs of the smaller manufacturers will be found in the table of engines.

A few words should, however, be devoted to another category of power plant, the small gas turbines produced by *Société Turboméca*. Without these low-power engines the designers of trainers and high-speed touring aircraft would have been faced by a virtually insoluble problem. Licences for the *Piméné, Palas* and *Marboré* turbojets, the *Aspin* by-pass engine, and the *Artouste* and *Orédon* shaft turbines have been sold to Britain and the United States. Several new aircraft designs in America—and more recently in Japan—have been based on Turboméca engines (the U.S. Air Force's Cessna T-37 two-seat trainer with two *Marboré IIs;* the Japanese firm of Shin Meiwa's KJT-01 trainer projects with two *Marborés,* etc.).

At present Société Turboméca's monthly output is about 40 engines of all kinds (turbojets, turboprops, shaft engines and turbo-compressors). This almost certainly does not represent the company's full production capacity. Roughly 60% of the 1,000 persons employed here are engaged on research and development work. J. R. Szydlowski, Turboméca's Board Chairman and Managing Director, has announced that his company's present programme covers new developments in the turboprop field (1,800 to 4,000 h.p. class), and two new gas turbines will be on display at the Paris Show... One of them may perhaps be the *Gabizos*.

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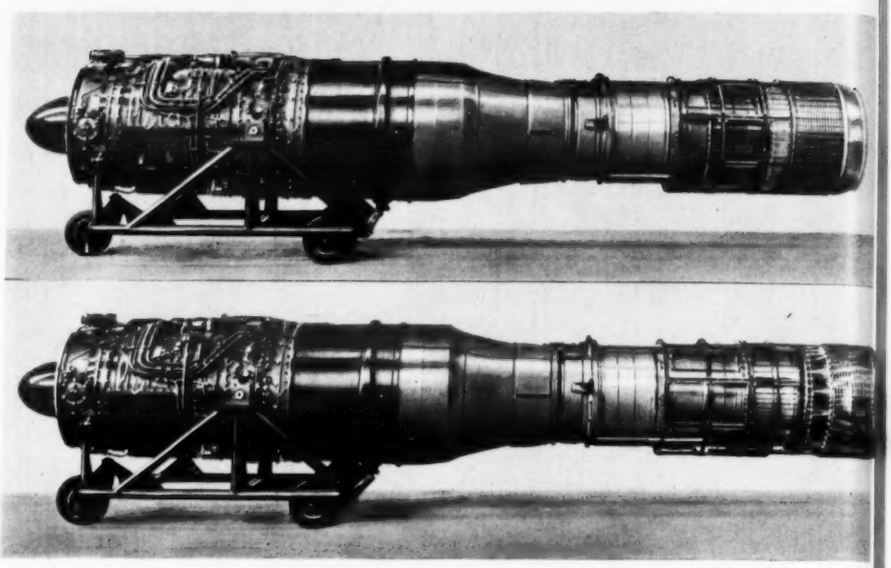
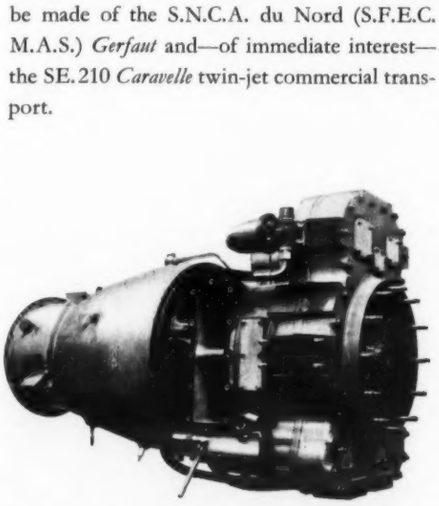
But this is digressing from the subject of production into that of research and development. May *Interavia's* Editor, who lays store on logical arrangement, shut his eyes to it just this once.



SNECMA-ATAR 101 turbojet with jet deflector (bottom: device in extended position for deflection).

Research, Too

Despite the satisfaction felt at seeing a number of aircraft and engines in production, the importance of continued research and development is not forgotten. There is scarcely a major aircraft manufacturer that is not concerned in N.A.T.O.'s design contest for light interceptors and ground attack aircraft; scarcely an engine manufacturer of note that has not been working on a power plant for this light aircraft class (Hispano Suiza R.800, S.N.E.C.M.A. R.105, Turboméca *Gabizos*)... The data available on new designs such as the Bréguet 1050, Nord *Harpon,* Nord 2600, Sud-Est *Durandal,* Hurel-Dubois HD. 70 etc., are listed in the accompanying aircraft table; details of their structure and performance will be published after the Paris Show. Special mention should be made of the S.N.C.A. du Nord (S.F.E.C. M.A.S.) *Gerfaut* and—of immediate interest—the SE.210 *Caravelle* twin-jet commercial transport.



Turboméca Artouste II 400 h. p. gas turbine, as used for example in S.N.C.A. du Sud-Est's SE. 3130 helicopter.

Delta-wing models to the fore

At the moment there are four delta-wing aircraft that bear French nationality markings: the small Payen PA.49 experimental single-seater, the Dassault MD.550 single-seat interceptor prototype, the SE *Durandal* prototype (still under construction) and the S.N.C.A.N. (S.F.E.C.M.A.S.) 1402 *Gerfaut* light single-jet single-seater, of which a small pre-production batch is shortly to be built. Fitted with a SNECMA-ATAR 101C turbojet of 6,170 lbs. s.t., this interceptor is unusually squat in shape and has a delta wing of only 6% thickness ratio and a 60º leading edge sweep. The main units of the Messier undercarriage are, surprisingly enough, retracted into this very thin wing. Another unusual feature is the large-area rudder unit which carries at about mid-height a small slab horizontal plane (also of delta shape). Sandwich materials have been used for the ailerons and landing flaps, which are operated by means of irreversible servo controls.

The type designation of this aircraft reveals that its development was begun by Société Française d'Etude et de Construction de Matériels Aéronautiques Spéciaux, which has since been absorbed by S.N.C.A. du Nord. A S.F.E.C.M.A.S. experimental glider, the 1301, to test the flight behaviour of extremely thin delta wings with large leading edge sweep preceded the *Gerfaut,* the first version of which began flight testing at Istres, southern France, in mid-January 1954. During these test flights speed was progressively increased according to a set programme, and by early April 1954 S.F.E.C.M.A.S. test pilot Capitaine Turcat

reached supersonic speed—without thrust-increasing devices. Subsequently the extremely manoeuvrable aircraft was fitted with a new wing unit of similar design but larger area. With the addition of an auxiliary rocket engine it will now be able to reach speeds of Mach 1.3+ in level flight. The makers announce that this heavily armed interceptor will be cheaper to produce than corresponding foreign types.

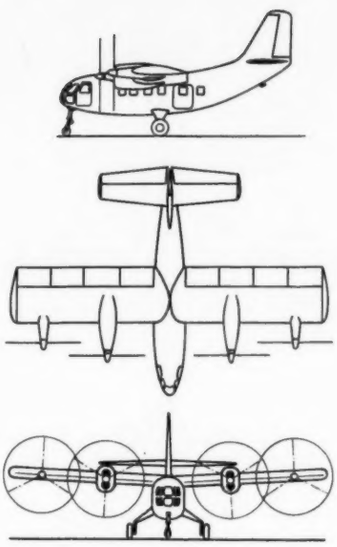
A trumps card for Paris... the Caravelle

Some four years ago, the Secretariat General for Civil and Commercial Aviation worked out, in conjunction with the French airlines, a specification for a twin-engined medium-stage commercial transport. The plans were then passed to a number of aircraft manufacturers with the invitation to submit appropriate projects. The winner of the contest was the twin-jet *SE.210 Caravelle* designed by Pierre Sartre, Chief Engineer at S.N.C.A. du Sud-Est's Toulouse branch. A first prototype, completed towards the end of April 1955, will have made its first test flights by the time these lines appear in print. A second prototype, modified in several respects, is being built at Toulouse.

Opinions vary as to whether the *Caravelle* will come on to the market too early or at just the right moment. Allowing for the fact that works and operational testing take considerable time, it appears that this medium-stage transport will be ready at about the beginning of the period in which the long-range jet types now under development in the United States and Britain will have completed their experimental stages.

Apart from these considerations the *Caravelle's* general design is worthy of interest. The two jet engines are mounted on the sides of the fuselage behind the passenger cabin, thus leaving the whole wing clear to its roots; as the thrust axes of the engines practically coincide with the aircraft's longitudinal axis, the asymmetry caused by the failure of one engine or by power fluctuations is hardly discernible; passenger comfort has been substantially increased by a reduction in noise level in the cabin and there is less danger to occupants in the event of fire in an engine (fuel tanks away from engines) or failure of a turbine rotor etc. Another attraction is the *versatility* allowed for right from the initial design stage. In its present form the *Caravelle* can be used, without major conversion, for passengers (70 to 91), mixed passenger/freight transport or pure freight carriage (for military transport).

The question of *reliability* has also received exemplary attention. For example, the *Caravelle* has two main hydraulic systems which feed two independent servo control systems. Additional reliability has been obtained by providing a third hydraulic system, fed by an electric pump, to supply one or other of the servo systems, as required, in an emergency. Before being fitted in the two prototypes, all main assemblies (e.g., the pressure cabin, the various circuits, the Hispano Suiza undercarriage etc.) were subjected to endurance tests under realistic operating conditions on specially designed test beds.

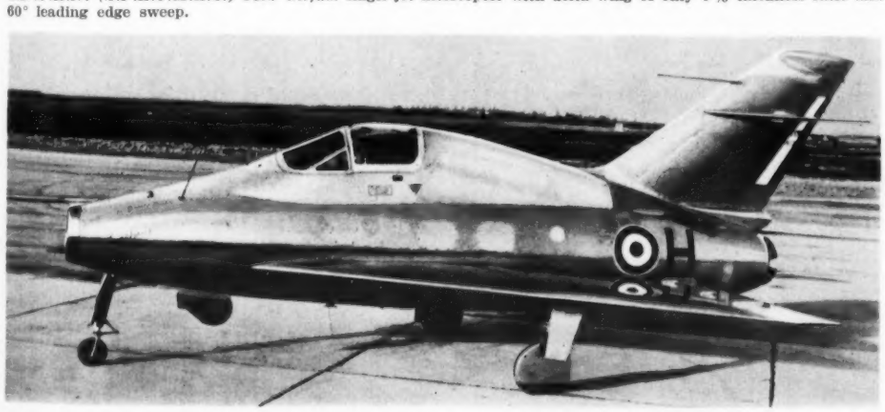


Bréguet 940-01 feeder airliner project for very short take-off and landing distances.

Bréguet 1050 three-seat, anti-submarine aircraft with *Dart* turboprop.

Hurel-Dubois MD. 70 project for a turboprop feeder transport.

S.N.C.A.N. (S.F.E.C.M.A.S.) 1402 Gerfaut single-jet interceptor with delta wing of only 6 % thickness ratio and 60° leading edge sweep.



EQUIPMENT IN BRIEF

An efficient equipment industry is indispensable

It would be almost too obvious to stress the decisive part played by the equipment industry in modern aircraft and engine manufacture. The accompanying "A.B.C. of the French Equipment and Accessories Industry" provides a guide to the highly ramified programme of some of the leading firms in this important, though less spectacular, branch of the French aviation industry.

"Age of rearmament... age of equipment." The slogan of two years ago is even closer to the truth today, thanks in part to the energizing effect that the large-scale production of aircraft and engines has had on the activity of the equipment industry.

Off-shore contracts and orders from America's Republic Aviation Corp. have raised *Air-Equipement's* production to a level never before known.

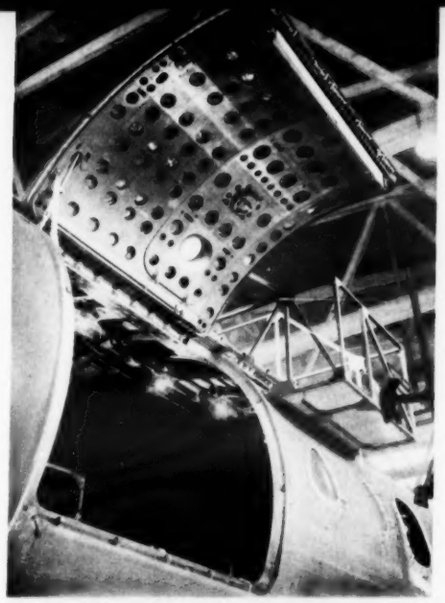
Undercarriage components, hydraulic valves, metering equipment for oxygen systems and pressure gauges for lubricant and hydraulic systems are among the items made for Republic. Starter motors have been among the company's

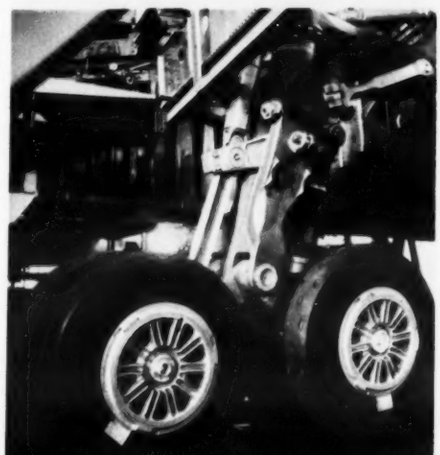
standard products for many years. A new departure has been made to meet the simplification and miniaturization programme set up for certain categories of aircraft and engines. Air-Equipement makes, for example, Duplex ignition systems for the *Viper* turbojet and starters for low-power turbojets (R.800, *Gabizos?* etc.). Fuel pumps and metering equipment for jet engines, D.C. generators and aircraft instruments such as artificial horizons, turn-and-bank indicators, magnetic compasses and the widely-used Bendix AN/ARN 6 radio compass (Nord 2501, *Vautour,* F-84 etc.) are produced under Lucas and Bendix licences, and the work programme includes transmitters and receivers.

Engine accessories and pneumatic and electrical equipment for the most varied uses continue to account for the major share of *Bronzavia's* production. Like Air-Equipement, Bronzavia has for years been producing fuel pumps, compressors, D.C. motors, cabin pressure blowers etc. Complete air conditioning systems are also turned out in substantial numbers. A precision mechanics and optical division makes bomb sights, camera guns and optical drift meters.

Messier's lead in undercarriage manufacture remains uncontested. Special reference should be made to the "Ministop" brake pressure regulator which is now to be fitted, following successful tests, to all Air France's Vickers *Viscount* turboprop transports. A detailed description of this device is being prepared for a forthcoming issue of *Interavia.* Messier is also preparing to enter the electronics field.

A television transmission system with which radar images can be transmitted over a distance of 20 miles and there displayed on a television screen was recently demonstrated by *Compagnie Générale de T.S.F.* (*C.S.F.*) and *Société Française Radioélectrique (SFR).* The radar image is converted into a television picture (of considerably stronger intensity and light and shade contrast) by means of a new-type "memory tube" which feeds the television image to the image converter in the form of electrical impulses. The memory tube can also "store" the radar image for a certain period of time. The system, one of the two firms' latest creations, should be of particular value to military users, since with its aid radar images of all kinds can be transmitted, without the intervention of a television camera, to distant receiving stations and there displayed over a longer period.—Other major products of the two companies include fixed and mobile radar equipment, including field equipment and large installations for air traffic control, instrument landing installations, other airport equipment and air navigation instruments.





S.N.C.A. du Sud-Est's *SE. 210 Caravelle* twin-jet medium-stage commercial transport, a trump card for Paris. — Top to bottom: the cargo doors (the stress analysts had a tricky problem in providing an opening of 6.5 × 5.9 ft. in a pressure cabin). — Hispano Suiza main undercarriage unit. — Cut-outs for the cabin windows (and emergency exit); the shape of the windows gives maximum view downwards with minimum area. — The arrangement of the two engines on the sides of the fuselage, behind the passenger cabin, gives an undisturbed wing profile and increases reliability and passenger comfort.

Compagnie Française Thomson-Houston (CFTH) has won international fame during recent years through the supply of GCA equipment to Brussels-Melsbroeck, Amsterdam-Schiphol, Milan-Malpensa, Copenhagen-Kastrup and Geneva-Cointrin Airports, and the installation of the radar equipment for Paris-Orly regional control (officially handed over to the French Minister for Public Works, Transport and Travel by E. de Lassus, CFTH's Chairman and Managing Director, on December 16th, 1954; cf. *Interavia* No. 2, 1955). The company is also continuing development work in the complex field of radar and telecommunications engineering, one of its goals being to increase the range of radar equipment without a corresponding increase in power. Work is also being carried out on airborne storm-warning radar, and considerable attention is being paid to the construction of portable miniature transmitter-receivers. A "walkie-talkie" type of equipment, developed especially for infantry use, has been ordered by the American armed services and is now in licence production in the United States. Finally a branch of the company is working exclusively on the development of transistors (for use in guided missiles).

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Foreign research contacts

Having realized during the early post-war years how serious it is to lose touch with international research, France's *Union Syndicale des Industries Aéronautiques* now makes sure of regular contact between French designers and their colleagues in other countries. A number of conferences are held every year, and the *Association Française des Ingénieurs et Techniciens de l'Aéronautique (A.F.I.T.A.)* is organizing an international congress during the 21st Paris Show, to deal with the subject of "Aircraft Equipment".

Britain's Participation in The Paris Salon 1955

BY INTERAVIA'S LONDON EDITOR

A milestone in British aircraft engineering: the English Electric P. 1 single-seater fighter, which is capable of sustained supersonic speed in level flight. Twenty prototypes are on order. The aircraft – the first in-flight photograph is shown here – will not appear at Paris.

Salon by Salon the number of British exhibitors at the Paris Show increases—due to the growing importance of the N.A.T.O. market, keener competition in engine and airframe sales, and the wider use of British ancillary equipment and accessories in Europe.

This year there are no less than 38 British firms at Paris, including 11 airframe and 5 engine manufacturers and 22 companies from the supporting industry. Export is a high priority on all their lists, and Paris is a natural outlet.

Aircraft Industry

Largest single British group in the Show is, of course, the *Hawker Siddeley Group Ltd.* who hold big off-shore orders for the Hawker *Hunter* fighter. In the flying display will be a *Hunter 4* of the type now under licence production in Holland and Belgium.

Depending on Ministry of Supply sanction and the exigencies of the test programmes an Avro *Vulcan* delta bomber powered by four Bristol *Olympus* jets, a production two-seat Gloster *Javelin* all-weather fighter, and an Armstrong Whitworth-built Hawker *Seahawk FB.4* naval jet fighter will put in an appearance. Further *Hunters* may perform in the shape of an R.A.F. aerobatic team.

On the Group's joint stand will be exhibits by *Hawker Aircraft, A.V. Roe, Armstrong Whitworth, Gloster Aircraft, Armstrong Siddeley* and *Air Service Training.* The unusual self-contained gun-pack of four 30-mm Aden cannon for the *Hunter* will be shown along with an Armstrong Whitworth ground-to-air missile test vehicle, *Sapphire, Mamba* and *Snarler* power units, examples of the Avro type of honeycomb construction and a 1/12 scale model of the A.S.T. towed target which has now been ordered by the Ministry of Supply.

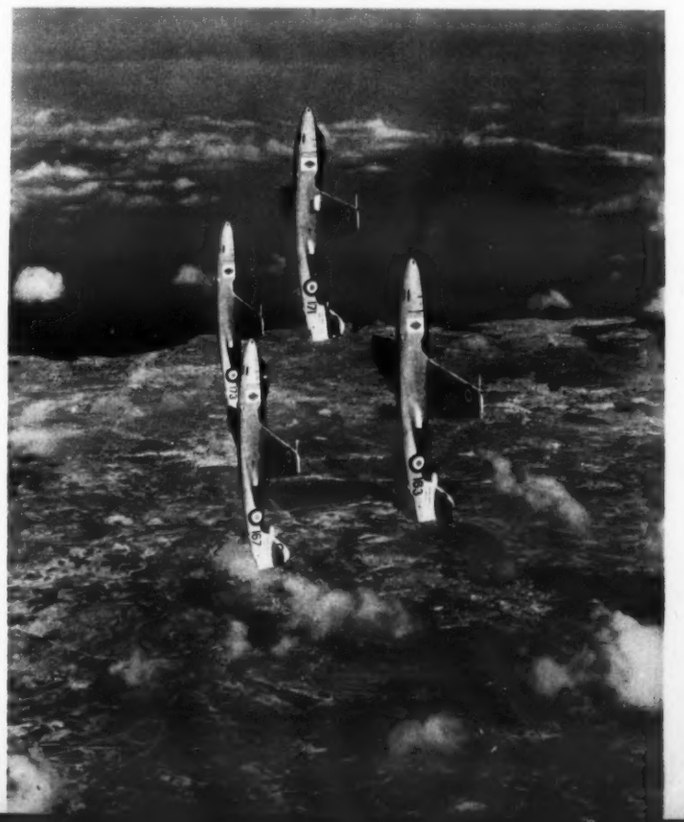
On a separate stand another Hawker-Siddeley Group subsidiary, *High Duty Alloys Ltd.* are featuring the use of Hiduminium aluminium alloys for high strength at elevated temperatures. The main features of the stand are examples of forgings in a new alloy, Hiduminium 100. This material is now beyond the development stage and it has many characteristics giving great advantages over existing alloys. Two of these are its recovery after repeated soaking at high temperatures and its resistance to corrosion, which is equivalent to that of pure virgin aluminium. The examples indicate its machining properties, forming from sheet and as a compressor blade and piston forging. Other exhibits will include Hiduminium R.R.58 as an impeller forging, Hiduminium R.R.77 as extrusions, and a second relatively new alloy, Hiduminium R.R.350, as a sand casting.

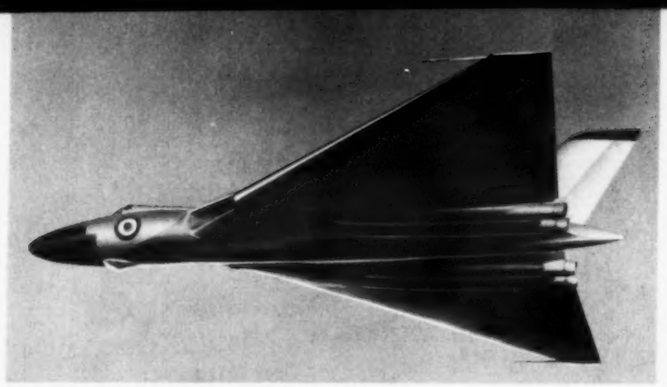
The English Electric Group will be present in strength for the second time in Paris.

A production Gloster *Javelin* twin-jet fighter on a flight from Moreton Valence, Gloster Aircraft's test airfield.

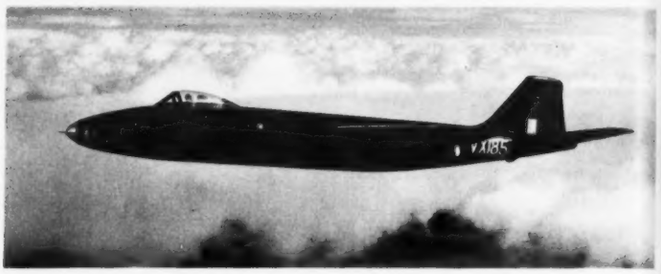
Hawker *Hunter IV* jet fighters are rapidly going into service with the Royal Air Force. This line-up belongs to No. 98 Squadron, R.A.F., at Jever air base, Germany, which is a component of the Second Allied Tactical Air Force. The 2nd A.T.A.F. is the first of five N.A.T.O. Air Forces to receive this type of aircraft.

Hawker *Seahawk* naval jet fighters "aerobating" in the skies of Malta.





The third Avro *Vulcan* delta-wing bomber, powered by four Bristol *Olympus* jets.



The English Electric *Canberra* Mark B. 8 night intruder.

The *Canberra* in its high altitude bombing, interdictor, photographic reconnaissance and training rôles continues in big demand—the latest country to purchase being Ecuador. The French Air Force are now using a number of *Canberras* for research and development work. Showing off the *Canberra's* manoeuvrability will be one of the R.A.F.'s latest Mk.8 night intruders, while a T.Mk.4 trainer will be in the static park.

On the English Electric stand will be a model of the "Deuce" digital electronic computing machine which is now in commercial production, and a wide range of items from the Aircraft Equipment Division including a.c. electrical systems, with Sundstrand constant speed drive and 40 kVA alternator, control gear, a circuit breaker, relays, transformers, motors, d.c. actuators, wide speed generator, 500 W invertors, d.c. motors and representative blowers incorporating d.c. motors.

The *Napier Engine Co Ltd.,* subsidiary of E.E.C., will have a sectioned NEl.3 *Eland* turboprop on view, complete with four-blade Rotol propeller, and spinner and intake utilising the Napier "Spraymat" de-icing system. Apart from the helicopter application of the *Eland* for the Fairey *Rotodyne,* interest in the straight *Eland* for aeroplanes is growing abroad. A Convair 340 and an *Ambassador* are being fitted with *Elands,* and a production batch of the NEl.3 is now on the line in the company's Liverpool works.

Also of considerable interest is the Napier *Oryx* helicopter gas generator which is progressing well and will equip the Hunting Percival P.74 eight-seater helicopter now under construction.

Third firm in the Group at Le Bourget is *Marconi's Wireless and Telegraph Co. Ltd.* The Marconi section of the stand will contain a representative selection of the Company's aeronautical radio equipment, a big feature of which will be a demonstration of the AD.307 multi-channel, self-tuning H.F. transmitter/receiver, which is being exhibited at Paris for the first time. This equipment is primarily designed for pilot-operated radio-telephony service, and 200 crystal-controlled channels are available. Entirely automatic frequency changing with self-tuning circuits is provided.

An aircraft set on public view for the first time is the AD.704 VOR/localiser/communication receiver (with frequency coverage of 108-136 Mc/s.), which forms part of the new Marconi AD.704/706/708 receiver combination for VOR/ILS, the other units being the Glide Slope and Marker receivers.

Other Marconi equipments will include the AD.115 VHF/multi-channel communication transmitter/receiver, the AD.7092D automatic direction finder (radio compass), the AD.401 intercommunication equipment, a console unit of the AD.200 VHF automatic direction finder, the aerial exciter unit of the AD.503 VOR and scale models of a VOR beacon, and the new Marconi S.232 crystal-controlled airfield radar.

It is hoped that—test programme allowing—*The Bristol Aeroplane Co. Ltd.,* will be able to fly the *Proteus*-powered *Britannia* turboprop airliner at least during some part of the Show.

Definitely flying will be the types 171 and 173 helicopters. On the stand there will be a model of the new type 191, an anti-submarine helicopter developed from the 173 with a redesigned fuselage and powered by two Alvis *Leonides* radials. The 191 prototype is now under construction.

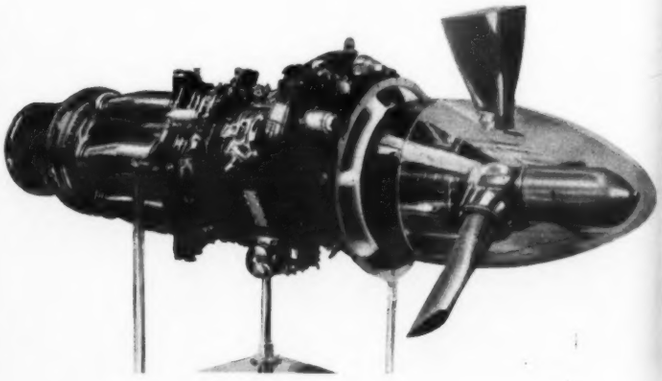
Bristol's Engine Division will be strongly represented with an *Olympus 101* of the type fitted to the Avro *Vulcan,* a sectioned *Proteus 705* as on the *Britannia* airliner, and a sectioned *Centaurus 661* piston engine. It is not known whether the company will be able to show its *Orpheus* lightweight turbojet which is attracting attention in many European countries and in the U.S.A.

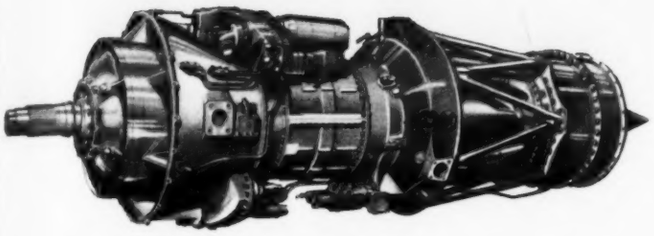
Having a remarkable power-weight ratio—an output in full production form of 4,850 lbs. thrust for only 850 lbs. weight—the *Orpheus* has been running most successfully since last December. Several units have been completed and progress has been such that Folland Aircraft should be able to take delivery of a flight-cleared engine for the *Gnat* light interceptor during June, although naturally at lower thrust than the production unit.

European Air Forces and Navies will be watching with interest the Short *Seamew* making its first demonstration outside the U.K. On view and flying will be a production

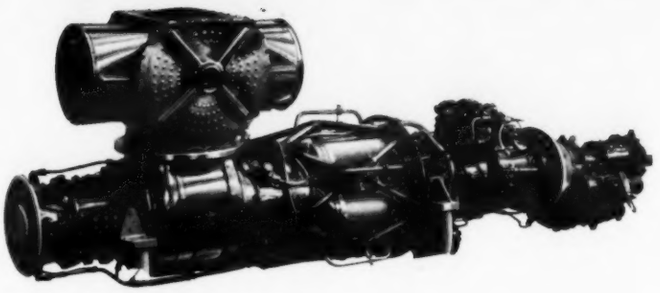
The Bristol *Olympus 101* turbojet, the dry thrust of which is believed to be well above 10,000 lbs.

The Armstrong-Siddeley *Mamba* turboprop of 1,400 h.p.-plus.





The Napier *Eland* of 3,000 h.p.-plus, one of the most promising of British turboprops.



The Napier *Oryx* helicopter gas generator.

machine, probably in R.A.F. Coastal Command colours. It will be recalled that the *Seamew* is on order for both R.A.F. and the Fleet Air Arm.

Several N.A.T.O. countries could utilise the rugged *Seamew* to good effect for both escort carrier borne and inshore patrol work. With comprehensive search radar equipment and capacious weapons bay, the *Seamew* has the added attractions of simplicity and cheapness. On the stand of *Short Brothers and Harland Ltd.* will be a working analogue computer and various *Seamew* components.

Handley Page Ltd. are devoting their stand to models and studies of the four-jet crescent wing *Victor* bomber and the *Herald* transport powered with four *Leonides Majors. Heralds* are now on order for three airlines, and this sturdily built 36-44 seater should provide a useful DC-3 replacement. The prototype is expected to fly later this summer.

Vickers-Armstrongs hope that an Air France *Viscount* may grace the display at some time, and if possible a *Valiant* bomber (four *Avons*) will fly. Models on the company's stand will cover the *Viscount, Valiant,* Vickers 1000 and the Vickers Supermarine 525.

Fairey Aviation will not have any flying exhibits although the Fleet Air Arm will demonstrate two *Gannets AS.1* and a *Gannet T.2.* On the Fairey stand will be models of the FD.2 *Avon*-powered delta research aircraft and the new ultra-light helicopter for army support work, now on test, and powered by a Blackburn-Turboméca *Palouste.*

Saunders Roe will be flying the *Skeeter Mk.6* light helicopter with a *Gipsy Major* engine.

Of the engine manufacturers, *Rolls-Royce* will have a 10,000 lb. thrust *Avon,* a 1,810 lb. thrust *Soar* turbojet and a sectioned *Dart* turboprop on view; *Alvis* exhibit the *Leonides* and *Leonides Major* radials in horizontal and vertical (helicopter) form; and *The de Havilland Engine Co.* will exhibit a *Gipsy Major* and a *Super Sprite* rocket together with a panoramic presentation of the mixed power formula. *The de Havilland Aircraft Co.* will fly a *Vampire* trainer.

Equipment Manufacturers

Possibly the widest of specialised equipment will be on the *Dunlop* stand. There will be found air compressors, the Mk.3. hydraulic brake control valve, the *Maxaret* anti-skid brake unit, plate brakes, reducing valves from 3 p.s.i. to 6,000 p.s.i., pneumatic rams, various valves, piston and jet engine controls, infinitely variable follow-up controls, (including the latest type developed for the Fokker S.14 *Mach Trainer*) cocking cylinder for the Aden gun, thermal de-icing and several other items including, of course, undercarriage tyres and wheels. One new Dunlop product will be a resin impregnated glass-fibre air container.

Aero Research Ltd. will show mainly the uses of "Redux" metal-to-metal adhesives for bonding load-bearing aircraft structures. These adhesives have now been employed for eleven years in nearly fifty different types of aircraft ranging from airliners to guided missiles, and the theme of the display will be "proved durability" combined with instructional material to illustrate various applications of "Redux" in aircraft. "Redux" is now also supplied in the form of a film which simplifies the bonding of skins to metal honeycomb cores in sandwich structures.

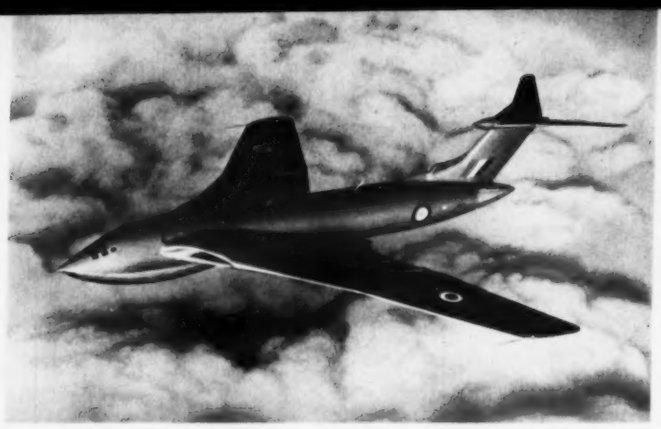
Standard Telephones and Cables Ltd. will show for the first time an entirely new development, the SR.32 100-channel ILS/VOR airborne navigation equipment which receives VOR, ILS and Marker Beacon information. The following frequencies are used: (a) any one of 100 channels in the I.C.A.O. navigational frequency band 108-117.9 Mc/s; (b) any 20 spot frequencies in the I.C.A.O. navigational frequency band 329.6-335 Mc/s allocated for the glide path portion of the ILS system; (c) 75 Mc/s, the frequency allocated for the Marker Beacon.

The SR.32 equipment comprises 3 main units and a control unit. The 3 main units are the localiser/VOR receiver, the glide path and marker receiver and the power supply.

The STR.20 560/623-channel VHF airborne communication equipment is also being exhibited for the first time at the Salon. The STR.20, specifically designed for use in military aircraft, provides 560 channels at 100 kc/s channel spacing or 623 channels at 90 kc/s channel spacing. A frequency synthesis system with built-in crystals is used. Any 20 channels can be made available for selection by the pilot. The STR.20 is the successor to the well-known Standard STR.9X series of VHF airborne communication equipment, more than

The Short *Seamew* anti-submarine patrol aircraft, on order for R.A.F. Coastal Command and the Royal Navy.

The first production model of the Bristol *Britannia* series 100 turboprop airliners, powered with Bristol *Proteus 705* engines. Production is well under way; Short Bros. and Harland Ltd. will start a second production line of enlarged *Britannia* versions.



The Handley Page *Victor* four-jet bomber, in production for the R.A.F.

The Vickers *Valiant B. 1* medium bomber, also in production for the R.A.F.

20,000 of which are in service with some 23 of the world's Air Forces.

Other items include STR.18C 100-channel pilot operated high power H.F. R/T airborne communications equipment; STR.18B-2 24-channel pilot operated high power H.F. R/T airborne communication equipment; STR.12D 140-channel airborne VHF set; STR.30B frequency modulated radio altimeter; A.2208 miniature display unit for cathode ray direction finders; and radio interference suppressors.

Engine starting systems, linear and rotary actuators, a.c. and d.c. switchgear, generating equipment, motors and ignition and lighting equipment form the *Rotax Ltd.* exhibit, while *Lucas (Gas Turbine Equipment) Ltd.*, will show a full range of fuel systems for turbojets and turboprops, and combustion equipment including space and anti-icing heaters.

Centre-piece of the *Rotol Ltd.* stand will be a propeller for the *Viscount's Dart* 510 turboprop which has square-tipped high activity blades and a number of other modifications. With this will be a control unit, feathering pump, synchroniser alternator and connecter motor and accessory gearbox for the *Dart*. Other items include a fuel flow proportioner, *Sapphire* accessory gearbox, a.c. 208 V motor with a *British Messier Ltd.* hydraulic pump (as installed on the *Britannia*), British Messier undercarriage for the *Gnat* and a tailwheel for the *Seamew*, and a power operated flying control.

Three Dowty Companies will be showing on one stand: *Dowty Equipment Ltd.*, main undercarriages for the *Hunter*, *Javelin* and Fokker S.14 and a *Hunter* nose wheel; also, Vardel hydraulic pumps, and electrical components including undercarriage indicators and lever and micro switches. *Dowty Fuel Systems Ltd.* will have fuel burners, fuel pumps and complete control and circulating units etc., for the Dowty gas turbine fuel system as used on the *Venom*. Finally *Dowty Seals Ltd.*, will exhibit their range of sealing media.

Theme of the *Henry Wiggin Ltd.*, stand will be improvements made in Nimonic Alloys, with various examples including a Rolls-Royce afterburner using Nimonic 75. A number of other applications for Nimonic products will be shown including Monoply sandwich with copper, Monel filtering elements etc.

The *Decca Navigator Co. Ltd.* will have on show their Mks 7, 8 and 9 receivers, flight logs etc., and the company's comprehensively equipped *Anson* will be available for flight demonstrations.

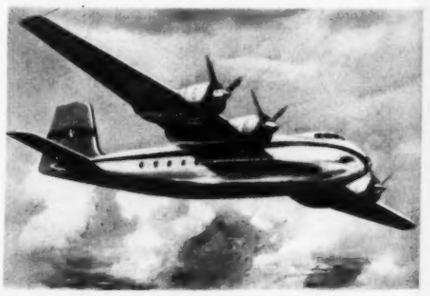
C.T. (London) Ltd., are organising a joint stand as agents for *Murphy Radio Ltd.*, *Martin-Baker Ltd.*, *Mechanism Ltd.*, *Sir George Godfrey & Partners Ltd.*, and *B.S.A. Precision Castings*.

Murphy's range at the Salon covers distance measuring equipment, types 1 & 6, MR.175 pulse generator, RB.110 one kW radar beacon, MR.255 beacon control equipment, MR.80 and MR.100 multi-channel airborne VHF, MR.69A passenger announcement equipment, and the type VR.61A 19V voltage regulator.

Highlight of the *Martin-Baker* exhibits will be the lightweight fully automatic ejection seat with the very low installed weight of 60 lbs. which is especially useful where weight and cockpit space are limited. The telescopic ejection gun with 80 ft./sec. velocity and with very low peak acceleration, will carry the occupant clear of the structure of any contemporary or projected aircraft.

Mechanism Ltd. specialise in sensitive instruments and will show machmeters, including a new type reading from Mach 0.8 to 1.8, air speed indicators, the R.A.E. fatigue meter, a transmitting accelerometer and a strain gauge transmitter.

Cold air units, a cabin supercharger, a water extractor and air supply equipment for a ventilated suit form the *Godfrey* exhibits, while B.S.A. have castings manufactured by the lost-wax process and used for turbojet, gun and generator parts etc.



The Handley Page *Herald* medium transport – a possible DC-3 replacement. Prototype is to fly shortly.

The Bristol Type 173 helicopter, ordered in quantity for the British armed forces.

Other British Salon exhibitors are *Simmonds Aerocessories Ltd.* with Nyloc self locking nuts and fuel gauges; *Plessey International* who show radio equipment, electronic instruments, and a wide range of aircraft electrical equipment. *H.M. Hobson Ltd.*, showing fuel metering and engine test equipment; *Jablo Plastics Industries* with lightweight plastic foam material for cushioning and insulation; *Lodge Plugs* display sparking plugs, jet igniters and ignition screening fittings; *Normalair* with cabin air control and oxygen equipment; and *Thermionic Products* who display their airport tape recorder.

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Now, payloads of up to 16,000 pounds of vital supplies can be delivered to our fleets—anywhere at sea!

Fairchild's M-216 "Flying Lighter" has load-carrying capacity and range far exceeding any aircraft now used for carrier-on-board-delivery—makes possible delivery of critical spare parts, electronic and communications equipment, tools and repair materials, engines, mail, cargo, munitions or food anywhere at sea, eliminating many costly and time-consuming surface re-supply operations.

Adapted from famous Fairchild C-123B Assault Transport, the new "Flying Lighter" gives wings to current problems of fleet supply—gives new mobility and independence, more flexible logistic support to fleet operations.

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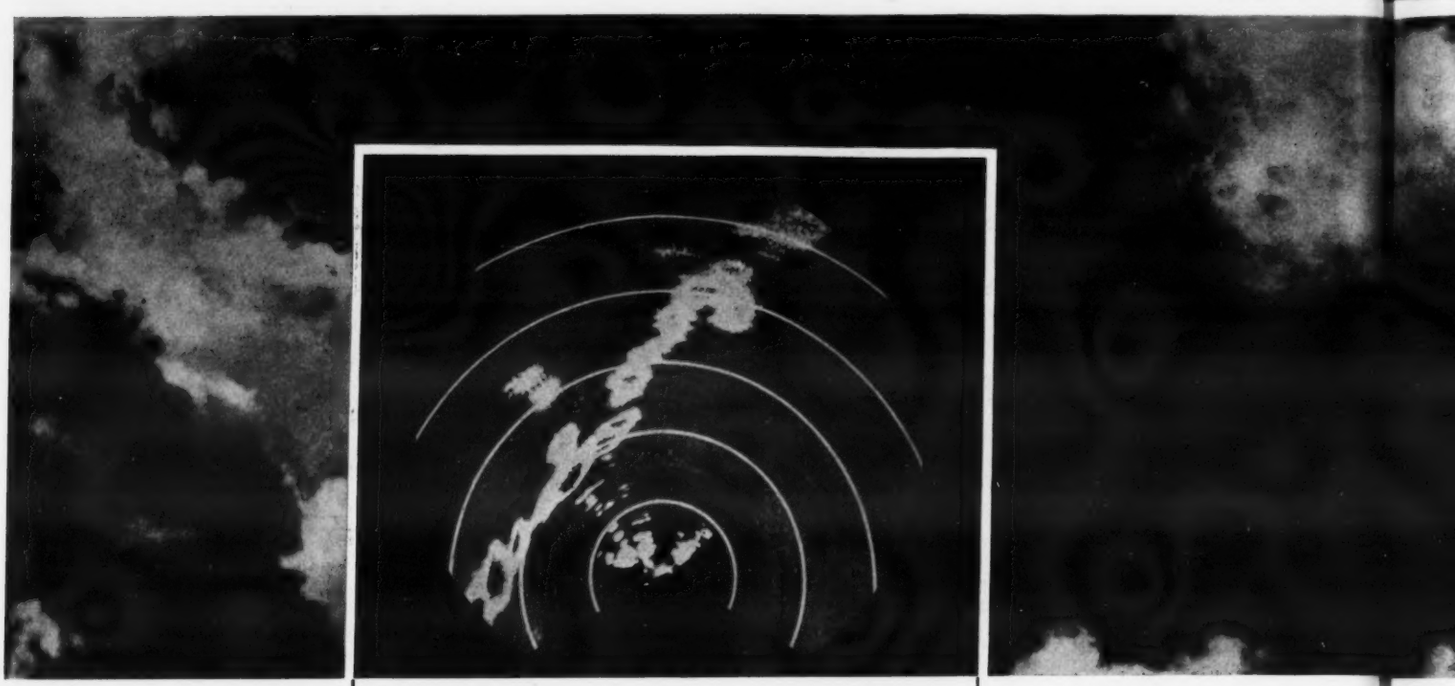
"where the future is measured in light-years"

Now you SEE the storms...



Actual storm ahead as pilot sees it on radar scope. It indicates that, by changing course very slightly, he will find a smooth, safe route.

Bendix AIRBORNE RADAR...

EITHER "X" BAND (3.2 CM) OR "C" BAND (5.5 CM)

Bendix * Airborne Radar, a device carried right in the airplane to spot storms miles ahead has been used by the military for several years. Now Bendix is supplying it to airline and company-owned aircraft.

This new device does what human eyes cannot do. It not only sees up to 150 miles ahead, even in the blackest night, but also looks right through storms and shows their size and intensity.

In the small photo above, for example, you can see white areas which are a line of storms. Those with black centers represent great turbulence. With only a slight change in course the pilot avoided these storms.

Airlines are buying Bendix Airborne Radar because it means improved flight safety through storm areas.

Without airborne radar it has often been necessary to fly many extra miles to avoid storms whose areas and intensities were not definitely known.

Pilots hail it as one of aviation's most important developments, not only because of its storm-warning accuracy, but because it also acts as a navigational aid. Even in heavy overcasts it can see rivers, mountains and the outline of the terrain below. Write Bendix International Division for further information.

finds a smooth corridor through stormy skies!

This is one of the hundreds of products Bendix has developed and manufactured for the aviation industry. We also make hundreds of other automotive electronic, nuclear and chemical components and devices for those and scores of other industries. A request on your company letterhead will bring you "Bendix and Your Business"—the complete Bendix story on how we can contribute to your business.

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Voltage regulators
Radio compasses
Medium-wave and short-wave telecommunications equipment

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Rate-of-climb indicators

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AIR-EQUIPEMENT

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Italy at the 21st Paris Show

The 1955 Paris Aircraft Show reveals the Italian aircraft industry rising like Phoenix from its ashes. Though certain firms, such as Breda and Caproni, have virtually disappeared, others are evidencing so remarkable a revival that the term "Italian aircraft industry" has regained its real meaning.

To mention only Fiat and AERFER as the leading aircraft producers, these two firms have recently booked million-dollar N.A.T.O., off-shore and U.S.A.F. orders, and Italian orders should follow. Piaggio & C., Genoa, which immediately after the war had to make motor scooters to keep its head above water, is doing a successful export business with the United States and Canada (and soon doubtless with West Germany). Though perhaps less spectacular, the situation in the equipment industry is also very promising.

FIAT – TURIN

The traditions of this Turin firm, one of the oldest aircraft and engine manufacturers in the world, with which the name of Giovanni Agnelli will always remain linked, are being continued under the conservative yet progressive leadership of its President Professor Valletta.

The first Fiat engine was built in 1908 and has been followed by 46 other types. Altogether Fiat has brought out 141 different aircraft types, which since before the war have borne the letter "G" to indicate Chief Designer Professor Giuseppe Gabrielli.

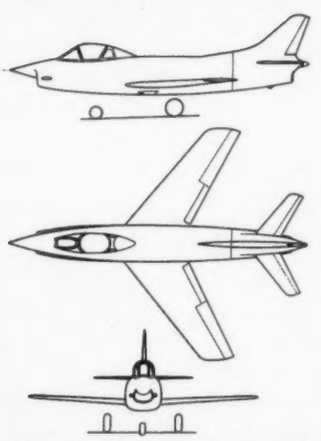
Today Fiat's *airframe* production activities cover two directions: piston-engined or jet *trainers* of the G.46, G.49. G.59, G.80 and G.82 types, on the one hand, and *combat aircraft for N.A.T.O.* on the other. The latter branch of production began after the war with the licence versions of the *Vampire* and *Venom* fighters and now extends to assembly and production of parts of the American F-86K *Sabre* all-weather fighter. A few weeks ago the $ 22,000,000 order placed in 1953 for fifty F-86Ks plus tooling was supplemented by a $ 9,000,000 follow-up order for assembly and parts for another seventy.

In addition, Fiat and its Chief Designer Gabrielli can look forward to producing aircraft of their own design. The *G.91* (Bristol *Orpheus*) appears to have emerged as the favourite from a N.A.T.O. contest for a light ground attack aircraft. At any rate a pre-production batch of three has been ordered by the Pentagon and an option taken on 27 more.

In its *engine division* Fiat first made *Ghost* jets after the war and later produced parts for the Allison J-35 and General Electric J-47 axial-compressor turbojets. Fiat is one of the

The Fiat office building in Turin.

The Fiat G. 82 two-seater, with Rolls-Royce *Nene 2/21* turbojet, is Italy's most modern trainer. In the foreground a Fiat G. 59 piston-engined trainer with Rolls-Royce *Merlin 500*.



Fiat is again producing combat aircraft of its own design. The Fiat G. 91 light single-seat ground attack aircraft with Bristol *Orpheus* turbojet.

The full line of Fiat trainers: G. 82, G. 80-3 B, G. 80-1 B, G. 59, G. 49, G. 46.

A test pilot climbing into his G. 82 ready for take-off. In front of the aircraft, the Turin automobile division's latest product, the miniature four-seater Fiat 600.

Drawing of the *Sagittario 2* interceptor under development at Aerfer.

European maintenance and overhaul centres for the J-47 engines in service with the N.A.T.O. forces. The company also carries out repairs to Italian, American and British piston engines, and still holds Hamilton Standard licences for propellers.

Fiat's exhibits at the 21st Paris Show will include its latest jet trainer, the G.82 (max. speed 580 m.p.h., service ceiling 42,650 ft., range 840 miles), which is also expected to take part in the flying display.

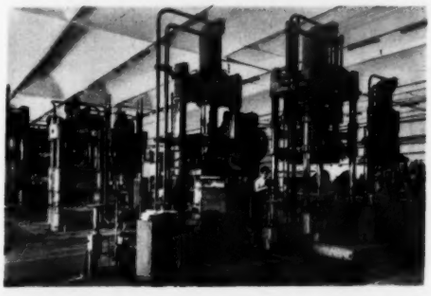
AERFER - NAPLES

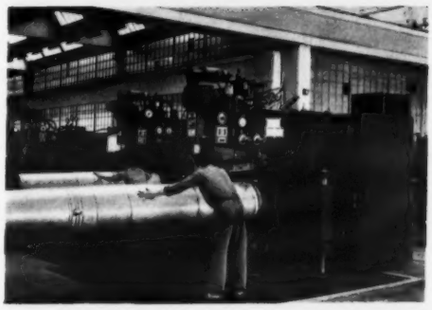
Second place among Italian airframe manufacturers is now occupied, thanks to its first-rate works installations and substantial offshore orders, by *Officine di Pomigliano per Costruzioni Aeronautiche e Ferroviarie (Aerfer)*, a member of the Finmeccanica Group, with plant near Naples. Under the leadership of Managing Director Dr. Ing. Amedeo Carassai (before the war Chief Engineer at C.M.A.S.A., Marina di Pisa, then belonging to the Fiat Group), this firm has secured extensive orders for spares—roughly 1,600 different parts—for N.A.T.O.'s Republic F-84G *Thunderjet* fighter-bombers, to an estimated value of several million dollars. Aerfer has the most up-to-date equipment and today employs about one quarter of the Italian aircraft industry's total labour force. A promising new design under development is the *Sagittario 2* light interceptor fighter with Rolls-Royce *Derwent 9* turbojet (cf. *Interavia* No. 7, 1954, pp. 443-445 and No. 3, 1955, p. 169).

In Paris Aerfer will have a model of the *Sagittario 2* on show, as well as 22 large photographs of its plant at Pomigliano d'Arco.

PIAGGIO & CO. - GENOA

The aviation activities of these well-known Genoese manufacturers of road, rail and air vehicles cover airframe, engine and propeller production. The main complete aircraft in production (for the Italian Air Force) is the Piaggio P.138 two-to-three-seat basic trainer, an all-metal low-wing model with 190 h.p. Lycoming 0.435A engine, fixed undercarriage and all-round transparent cockpit. A German industrial group recently acquired production rights for this aircraft in West Germany. In





The Aerfer plant at Pomigliano d'Arco contains first-rate equipment for metal aircraft production. Top to bottom: vats for surface treatment; hydraulic stretch presses; Sciaky electronically controlled machines (for electric seam welding of jet pipes).

addition a smaller number of Piaggio P.149 four-seat touring and communications aircraft are under construction, a type derived from the P.148 but with a more powerful engine (270 h.p. Lycoming GO-480) and retractable nose-wheel undercarriage.

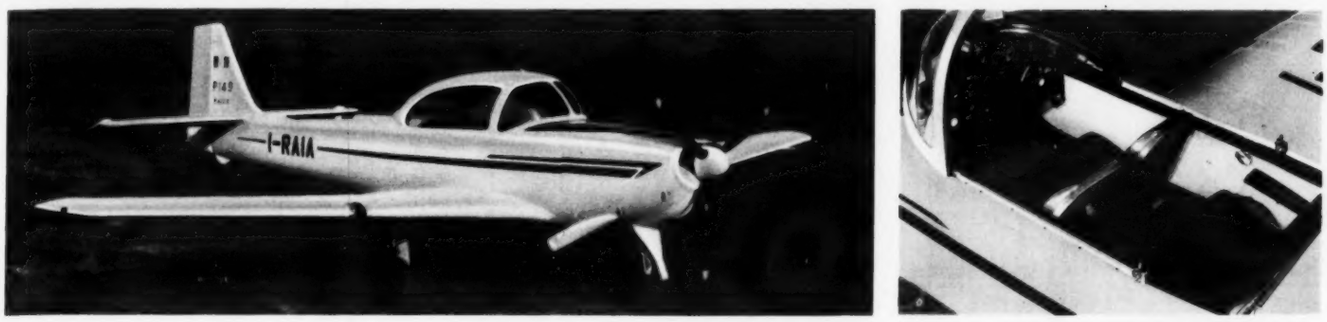
A particularly popular model is the Piaggio P.136-L twin-engined five-seat amphibian (two 270 h.p. Lycoming GO-480 engines), which is not only in service with the Italian forces, but is exported to the United States and Canada for use as executive aircraft, particularly by oil, coal and steel firms. C.A.A. recently certificated it, and Royal Aircraft Corporation, of Milwaukee, Wisconsin, has obtained production rights for it. This firm will initially assemble fifty aircraft from parts supplied by Piaggio and Lycoming engines delivered direct by the American manufacturers.

Although Piaggio has had many years' experience of engine manufacture and has in the past brought out many successful designs of its own, it is at present building only American Lycoming engines under licence from Avco Manufacturing Corporation, in particular the 0-435 A (190 h.p.), GO-435 (260 h.p.) and GO-480 (270 h.p.), all of which are fitted in Piaggio aircraft. The firm also makes P.1032

Assembly of tailplane parts for the Republic F-84G *Thunderjet* fighter/bomber at Pomigliano d'Arco.

Cockpit hoods for the F-84G are also produced in quantity at the Aerfer plant.

The Piaggio P. 148 two-to-three-seat basic trainer (with 190 h. p. Lycoming 0.435 A engine) is in production for the Italian Air Force.



Derived from the P. 148, the Piaggio P. 149 four-seat touring and communications aircraft is fitted with a 270 h. p. Lycoming GO-480 engine and P. 1033 three-blade constant speed propeller.

two-blade and P.1033 three-blade constant speed propellers for these engines.

New projects include the P.138 large twin-engined amphibian (with two 3,140 h.p. Napier *Nomads*) for sea rescue duties and the P.145 twin-turboprop commercial transport (two A.S. *Double Mambas*).

AGUSTA - GALLARATE

The firm of *Costruzioni Aeronautiche Giovanni Agusta* at Cascina Costa, near Gallarate, Lombardy, will exhibit its Agusta-Bell 47 G three-seat helicopter (with 200 h.p. Franklin 6V4-C.32 engine), built under licence from Bell Aircraft Co. In production in considerable numbers since 1952 (65 are planned), the first of these helicopters made its first flight on May 22nd, 1954. An initial batch of ten has been ordered for the Italian Air Force, and another ten for France. A number of others are to go to private customers in Italy and elsewhere, and additional orders are expected from the armed services. — With a gross weight of 1,900 lbs., the Agusta-Bell 47 G climbs to 5,000 ft. in 5 minutes and has a service ceiling of 15,000 ft.; for a gross weight of 2,350 lbs. corresponding figures are 8 minutes and 11,000 ft. Endurance is roughly four hours, max. speed 90 m.p.h., cruising speed 76 to 81 m.p.h.

THE EQUIPMENT FIRMS

Italy's equipment and accessories industry will be represented in Paris primarily by Fabbrica Italiana Magneti Marelli, of Milan, and Microtecnica, of Turin.

Magneti Marelli will show MCR 5 magnetos (for six-cylinder engines), ST 58 DTEM double magnetos (for eight-cylinder engines), ST 113 current regulators for generators and ST 34 DTEM starters for jet engines. High frequency equipment on display will be: CTR 38 B2 type VHF R/T equipment for airports (with remote control) working in the 100-156 mc/s band; frequency-modulated VHF transmitter-receivers for 31.7-41 mc/s; CTR 53 fixed UHF transmitter-receivers for 420-470 mc/s and frequency modulation, and simple RP 32 HF receivers for 1.5-30.5 mc/s.

Microtecnica's contribution will include synchronizing equipment and boosters for servo installations, as well as the interesting J8R attitude indicator and a number of transformers. As the firm is also very active in the field of automatic pilots and fire control equipment, it will probably show pictures to illustrate this branch of production.

The Italian *rocket industry* will be showing its products to the public for the first time, on a stand jointly organized by the three firms of *Polverifici Giovanni Stacchini* (Rome), *Stabilimenti Meccanici Riuniti Whitehead Moto Fides* (Leghorn) and *Compagnia Generale Italjet* (Rome). These three firms are financially

The Piaggio P. 136-L five-seat touring amphibian (two 270 h. p. Lycoming GO-480 engines) has proved especially popular. A P. 136-L taxying under its own power into the harbour at Genoa.

connected, Moto Fides and Stacchini each holding one third of the shares in Italjet. *Stacchini* will show the new *Orione* unguided surface-to-surface and surface-to-air rockets now in production (calibre 2¼ and 3¼ ins.), *Italjet* a 14AS-1000 Mk.2 JATO take-off rocket of 1,000 lbs. thrust, which burns for 14 seconds.

In the field of airport equipment the Turin firm of *Emanuel S.p.A.*, makers of air compressors, paint spray equipment and lifting tackle of all kinds, will display a model of the self-propelled crane for 100-ton aircraft it has under development. Fitted with diesel engines and direct current generators with a total power of 450 h.p., this "super crane", which itself weighs roughly 60 tons, will have two immense hydraulic jacks at the rear of a 41-ft. wide U-shaped chassis. While the chassis, approaching from the front, "surrounds" a crashed aircraft on both sides, two 44-ft. jibs, additionally supported by wheels at their ends, are laid over the wings. When the latter have been attached to the jibs there is a useful hoisting range of 10 ft.; the whole aircraft finally rests on the crane's eight rear wheels. — Dimensions are on the same scale as the crane's spectacular task; length without jibs 47 ft., with jibs extended 91.5 ft.; overall width 41 ft.; max. height 33.5 ft.; ten tyres measuring 600 × 635 × 1,770 mm.

OTHER EXHIBITORS

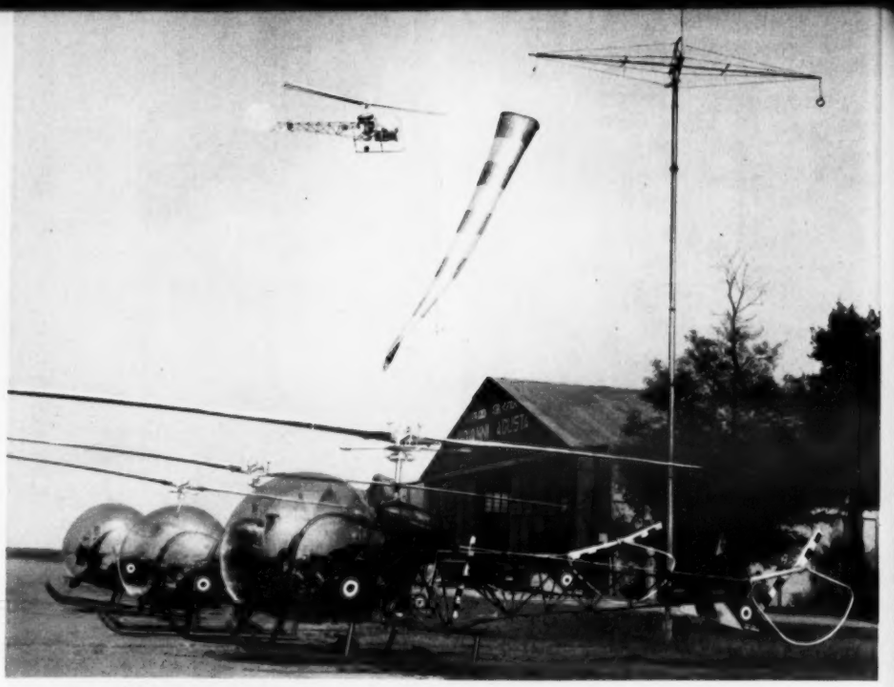
Of the Italian airframe and engine manufacturers not already mentioned, only *Società Aeronautica Italiana Ing. A. Ambrosini & Co.*, Milan, will have its own stand, but at the time of going to print nothing is known about what it will show.

Other firms and major equipment manufacturers will be represented collectively on two stands:

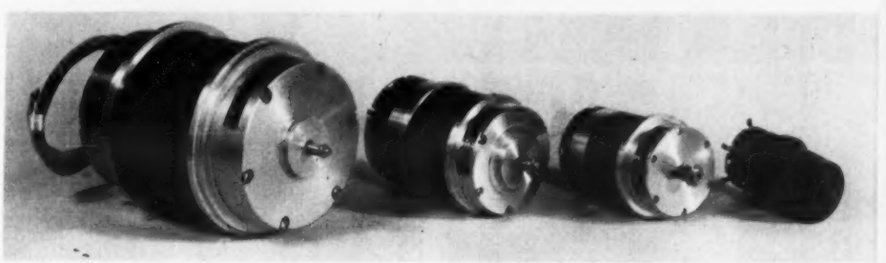
— *Associazione Imprese Aeronautiche*, the Association of Aircraft Manufacturers, which is headed by General Alfredo Bruno, present President of the International Association of Aircraft Manufacturers (A.I.C.M.A.); and

— *Centro di Informazioni e di Studio per lo Sviluppo degli Scambi Aeronautici con l'Estero*, headed by General Aldo Urbani, who retired as Chief of Air Staff at the end of 1954.

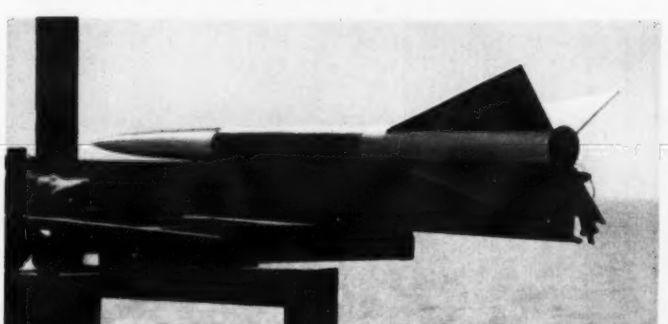
Altogether these firms number 41, of which the major ones—*Aeronautica Macchi* (Varese) and *SIAI-Marchetti* (Sesto Calende)—have recently brought out two new designs: Macchi is developing the MB.326 jet trainer with A.S. *Viper*, while SIAI-Marchetti is working on the SM.112 twin-engined navigation trainer (P. & W. R-1830s).



Agusta-Bell 47 G helicopter ready for delivery to the Italian Air Force at Cascina Costa, near Gallarate.



Microtecnica's series of synchronizing instruments (115 V; 60 c/s).



Orione unguided surface-to-surface and surface-to-air rocket (calibre 3¼ ins.) of Polverifici G. Stacchini (left) and 14AS-1000 Mk. 2 JATO rocket of Compagnia Generale Italjet (right).

Model of the salvage crane for 100-ton aircraft being developed by Emanuel, Turin.

The Netherlands' Contribution

BY INTERAVIA'S AMSTERDAM CORRESPONDENT

Five weeks before the opening of the 21st Paris Salon Holland celebrated the tenth anniversary of her liberation from foreign occupation and the end of a terrible war. Today the country and its people are prosperous again, its finances are in order and its industry fully occupied.

What has been accomplished in the past ten years of tenacious reconstruction is truly impressive. This is particularly true of aviation, as at the end of the war all airfields and most of the industrial plant lay in ruins. K.L.M. Royal Dutch Airlines had emigrated and was operating on a very reduced scale with a greatly shrunken fleet and staff, the Fokker plant had been demolished and the huge Philips factory at Eindhoven had been severely damaged by Allied bombing. Today Fokker, for example, is re-established in a big well-equipped factory (700,000 sq.ft. of manufacturing space) at the enlarged and modernized airport at Schiphol, Amsterdam, and K.L.M. has a large fleet of modern aircraft.

*

After the war *N.V. Koninklijke Nederlandse Vliegtuigenfabriek Fokker* turned to the production of trainers and designed the well-known S.11, S.12 and S.13 series, which was soon joined by the S.14 *Mach Trainer* jet trainer. The latter is now in production for the Royal Netherlands Air Force. Later the company started work on commercial transports and developed the twin-turboprop Fokker F.27 *Friendship*, two prototypes of which are nearing completion. Finally, Fokker has received large orders from the Dutch Government for production of the Gloster *Meteor Mk.8* and Hawker *Hunter* interceptors.

Today approaching 4,300 workers are employed at the main plant at Schiphol and the branch works at Ypenburg (Avio-Diepen) which was founded after the war by F.J.L. Diepen, now Fokker's Commercial Director. While the main plant is primarily engaged on quantity production, Ypenburg overhauls military transports for the U.S. Air Force. A large number of sub-contractors are also engaged on the fighter production programme, in particular Aviolanda at Papendrecht.

The products of the radio and radar industry are of major importance in modern flying, and the name of *Philips* is well-known in Holland and throughout the world in this field. The international Philips concern, which today owns production plant and research centres around the globe, built a new large factory at *Hilversum* after the war, known as *N.V. Philips Gloeilampen-Fabrieken, Telecommunication Division*. The installations at *Eindhoven* are also being repaired and modernized. At the beginning of the year the Dutch Philips branches alone employed nearly 51,000 workers, while the total labour force of the concern numbered roughly 123,000.

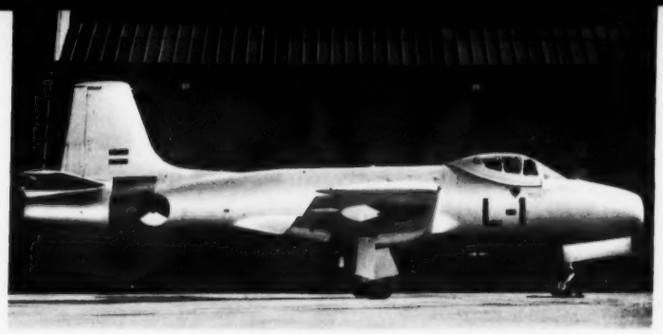
RECONSTRUCTION IN HOLLAND

Air transport: K.L.M. offices at The Hague.

Aircraft industry: Part of Fokker's new plant at Schiphol Airport.

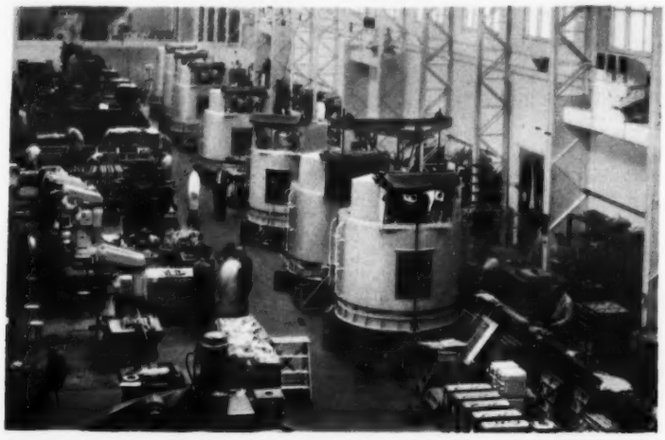
Radio industry: Philips' plant at Hilversum, where radio and radar equipment for aviation is produced.

Aeronautical research: Front view of the Nationaal Luchtvaart Laboratorium, Amsterdam.



Production model of the Fokker S. 14 *Mach Trainer*, with R.-R. *Derwent* jet engine.

Professor E. van Emden, Technical Director of the Fokker Works, congratulating his Chief Pilot Lieutenant Colonel G. Sonderman on the maiden flight of the first Hawker *Hunter* built by Fokker under licence.



The assembly shop at N.V. Hollandse Signaalapparaten, Hengelo, where fire control systems for ships guns are assembled.

One of the two prototypes of the Fokker F. 27 *Friendship* turboprop commercial transport has got to the point where front fuselage and wing centre section are being assembled.

Philips' research and production now covers the whole field of telecommunications. Of special interest to aviation are automatic telephone exchanges for airports (examples: Schiphol and Caracas) and teleprinter networks for line and radio operation (TOR = Teleprinter on Radio); point-to-point radio equipment for W/T and R/T communications between airports; ground-to-air VHF R/T equipment; portable and mobile VHF equipment ("Portophone" and "Mobilophone"); VHF link equipment; radar equipment; magnetic tape recorders for air traffic control and airport lighting.

Finally mention should be made of *N.V. Hollandse Signaalapparaten*, Hengelo, whose products include fully automatic fire control equipment for anti-aircraft guns and guided missiles.

Belgian Participants

The small but efficient aircraft industry of Belgium, the French capital's nearest N.A.T.O. partner, is also taking part in this year's Paris Show. Chief exhibitor is the *Groupement Belge des Constructeurs de Matériel Aéronautique (Gebecoma)*, whose 1,000-sq.ft. stand will display products from the following firms:

- Société Anonyme Belge des Constructions Aéronautiques (S.A.B.C.A.), Brussels.
- Stampe & Renard S.A., Brussels.
- Avions Fairey S.A., Gosselies.
- Fabrique Nationale d'Armes de Guerre (F.N.), Herstal.
- Ateliers de Constructions Electriques de Charleroi (A.C.E.C.), Charleroi.

S.A.B.C.A. will show a wing unit for the *Hunter* interceptor built (in conjunction with Avions Fairey) under licence from Hawker Aircraft, a Dowty undercarriage and various aircraft parts. *Stampe & Renard* will demonstrate the new aerobatic S.R. 7 *Monitor* basic trainer with 180 h.p. Blackburn *Bombardier* (on the airport) and a fuselage centre section of this aircraft (on the joint stand). The S.R. 7 is a two-seat all-metal low-wing monoplane with fixed tailwheel undercarriage, wich is also made by Stampe & Renard.

Fabrique Nationale's share in the exhibit will consist of a number of castings for the *Derwent* turbojet (Rolls-Royce licence), and *A.C.E.C.* its magnetic tape recorders for airports (models RVA 492, 481 GT and 133/2). Finally Belgian *Fairey* will be represented on the Gebecoma stand only by photographs of their plant and products, but will also have a stand of their own, probably showing parts for the Gloster *Meteor Mk. 8* and Hawker *Hunter* jet fighters in production at Gosselies.

America's Exhibitors at Paris

The United States aircraft industry will be represented at the 21st Paris Show by five major firms with world-wide interests. These are, in alphabetical order:

- *Bendix Aviation Corporation,* Detroit, Michigan, with numerous divisions and branches in the United States and several subsidiaries in other countries.
- *Curtiss-Wright Corporation,* Wood Ridge, New Jersey, with seven divisions and a number of associated companies.
- *General Electric Company,* Schenectady, New York, in particular its Aircraft Gas Turbine Division and International General Electric Company.
- *Republic Aviation Corporation,* Farmingdale, Long Island, N.Y., with subsidiaries in France (Republic Aviation Corporation of France) and Switzerland (Republic Aviation International S.A., Lugano).
- *United Aircraft Corporation,* East Hartford, Connecticut, its three manufacturing divisions Pratt & Whitney Aircraft Division, Hamilton Standard Division and Sikorsky Aircraft Division, and the United Aircraft Export Corp. of East Hartford and London.

*

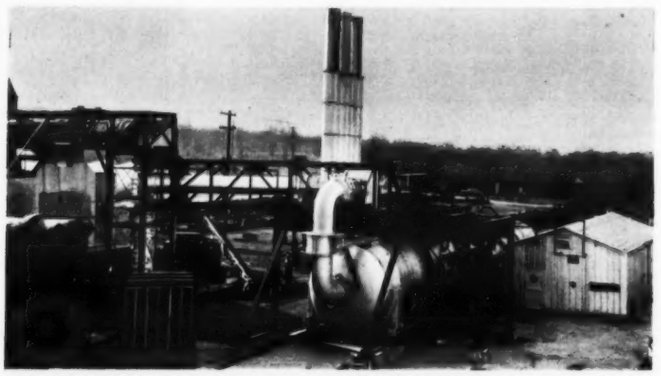
Bendix, the world's largest accessories manufacturers, which produces all kinds of aircraft equipment and aviation accessories, including radio and meteorological equipment, will show a selection of more than 300 products: navigation, radio and radar equipment, auto-pilots, measuring and checking instruments, ignition systems and fuel metering equipment, generators and transformers, meteorological instruments etc. — In this "age of equipment" such a collection can count on the interest of all pilots, designers and ground service experts.

Curtiss-Wright Corporation, whose Wright Aeronautical Division produces piston engines, turbojets, propeller turbines and ramjets, will be showing the reheat version of the J-65 jet (normal rating 7,800 lbs. s.t.), the 9-cylinder *Cyclone 9* radial engine (take-off power 1,525 h.p.) and a cut-away model of the *Turbo-Cyclone 18* compound engine (take-off power 3,500 h.p. at 2,900 r.p.m.; fuel consumption in cruising flight 0.39 lbs./h.p.h.). The J-65 powers eight U.S. military aircraft types (F-104, F11F, F-84 and RF-84F, B-57, FJ-3 and FJ-4, and A4D), the *Cyclone 9* is fitted in a number of medium-range aircraft (e.g., the HD. 31), patrol bombers and helicopters, and the *Turbo-Cyclone 18* in the long-range transports of thirty airlines (e.g., Douglas DC-7, DC-7B and DC-7C *Seven Seas,* Lockheed L-1049 *Super Constellation*). The Propeller Division of Curtiss-Wright will display its latest 13-ft. four-blade electric propeller, and the Electronics Division

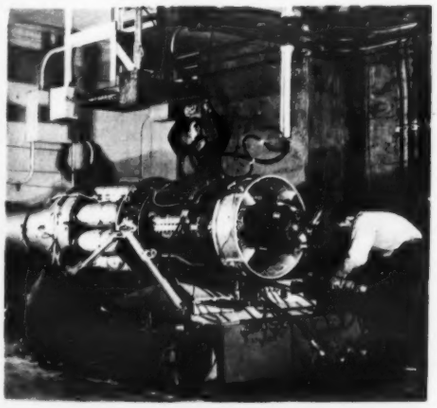
PRODUCTION AND RESEARCH PLANT OF THE FIVE AMERICAN EXHIBITORS

BENDIX AVIATION CORPORATION: The Eclipse Pioneer Division of Bendix achieves highest precision in the manufacture of the Polar Path gyro in its air-conditioned premises near Teterboro, New Jersey. The Eclipse Pioneer Division is only one of the Corporation's 22 branches, which produce all kinds of aircraft equipment.

CURTISS-WRIGHT CORPORATION: The Wright Aeronautical Division, of Wood Ridge, N.J., makers of piston engines, turbojets, turboprops and ramjets, has erected this test plant for ramjets. A recen Wright ramjet (X-10) is fitted in the SM-64 *Navaho* guided missile.

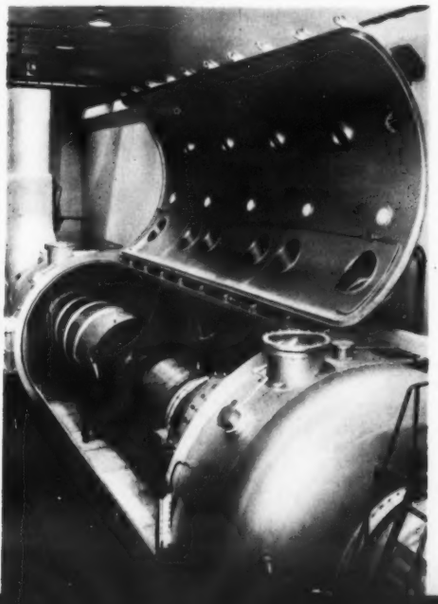


GENERAL ELECTRIC COMPANY: A J-47 turbojet on a test bed at the Aircraft Gas Turbine Division, Lockland, Ohio. This engine today delivers a normal max. thrust of 5,970 lbs. (GE-27 version) or 7,650 lbs. with reheat (GE-33 version).

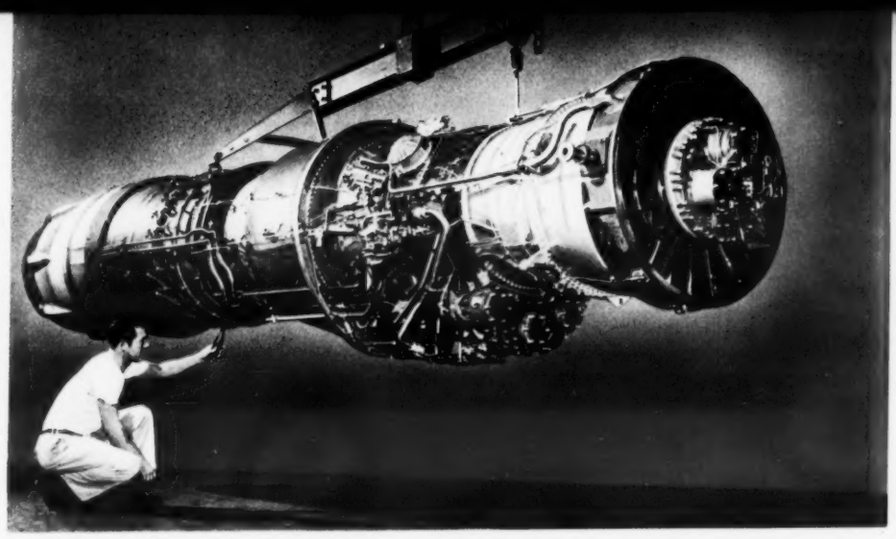


REPUBLIC AVIATION CORPORATION: Testing the operation of Republic's new light-weight ejection seat in the low-temperature chamber. The end of the seat belt hides the "preparatory" lever for ejection, but shows the trigger.

UNITED AIRCRAFT CORPORATION: One of the three new altitude test chambers (with J-57) at Pratt & Whitney Aircraft Division's Andrew Willgoos Turbine Laboratory, East Hartford, Connecticut. The J-57 has a max. thrust of 10,000-plus lbs.



Wright R-3350 *Turbo-Cyclone 18* exhaust-turbine twin-row radial compound engine, power plant for the Douglas DC-7, DC-7B, DC-7C *Seven Seas* and the Lockheed L-1049 *Super Constellation*.

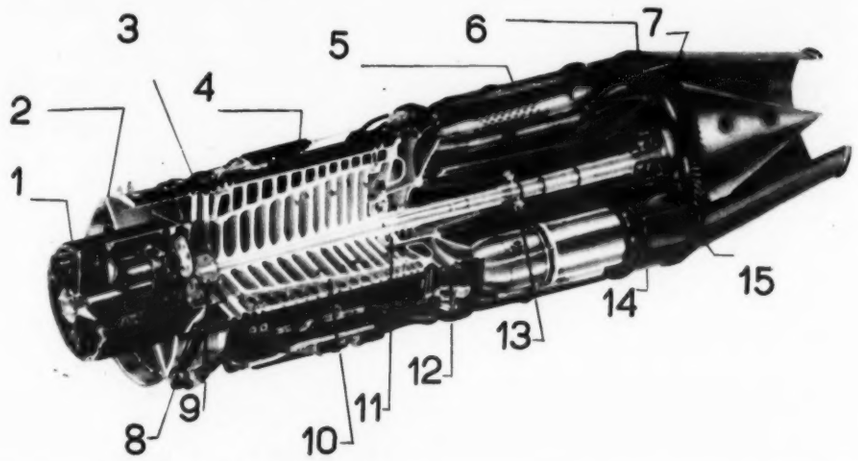


Pratt & Whitney J-57, P-13 twin-compressor turbojet with (short) afterburner, which powers the McDonnell F-101 *Voodoo* twin-jet supersonic fighter. Other models of the J-57 are fitted in the Boeing B-52 bomber, Boeing 707 tanker/transport, and North American F-100, Convair F-102, Douglas F4D and Chance Vought F8U fighters.

a Dehmel electronic flight simulator for the ten-engined Convair B-36 inter-continental bomber.

General Electric Company will be represented by a cutaway model of the J-47 axial turbojet, the J-47.GE-27 version of which delivers a max. thrust of 5,970 lbs. (for a consumption of 1.072 lbs./lbt.h) and a cruising thrust of 3,990 lbs. (at 1.009 lbs./lbt.h). The second version to be seen in Paris (J-47.GE-33) has a normal max. thrust of 5,550 lbs. (at 1.15 lbs./lbt.h), but reaches 7,650 lbs. with reheat (at 2.3 lbs./lbt.h). The J-47 has a diameter of 36.75 ins. and is 148.47 ins. long, or 228.44 ins. with afterburner; compression ratio 5.35:1; air flow 103.5 lbs./sec. Roughly 27,000 engines of this type have been delivered during the past seven years.—General Electric will also have the following items on display: model 7T-AS-12 turbo starter; model 2 CM 217 A5 and 2 CM 244 A2 aircraft generators; model 2 CM 88 D5A high-torque starter generator; and various ground power equipment, engine speed instruments, fuel flow meters and electrical switches and measuring instruments.

Republic Aviation Corporation, which is keenly interested in the European market on account of the thousands of F-84 *Thunderjet* fighter-bombers, F-84F *Thunderstreaks* and RF-84 F *Thunderflash* armed reconnaissance aircraft in service with N.A.T.O. forces in Europe, is expected to display its new light-weight ejection seat. In this design the traditional "curtain release" system (and hence the protection for the pilot's face) has been abandoned. Two movements suffice for ejection: 1– the pilot raises the protective leg braces, with either or both hands; 2– and squeezes the trigger in the hand-grip. Lifting the leg brace locks the shoulder harness, jettisons the canopy and arms the trigger, and squeezing the trigger ejects the seat and engages a time-delay device that releases the pilot's safety belt in two seconds. The new seat has already been subjected to extensive tests in a cold chamber.

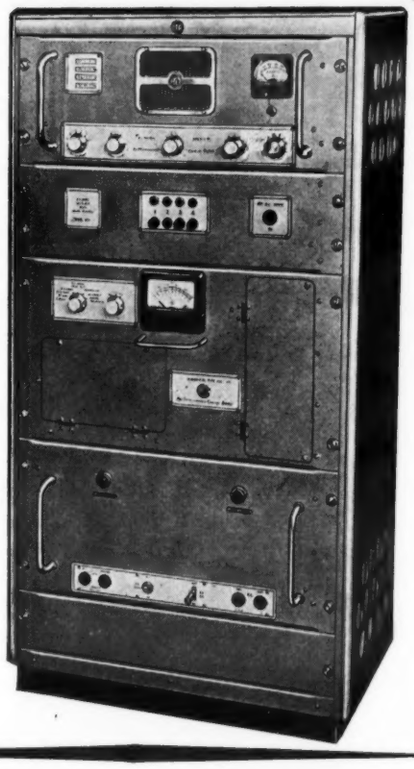


Sectioned drawing of the General Electric J-47 turbojet: 1 – accessory section; 2 – air guide section; 3 – front frame; 4 – split compressor casing; 5 – eight-can combustion section; 6 – nozzle diaphragm; 7 – turbine buckets; 8 – inlet screen; 9 – No. 1 bearing; 10 – twelve-stage compressor rotor; 11 – No. 2 bearing; 12 – mounting pad; 13 – No. 3 bearing; 14 – aft frame; 15 – No. 4 bearing.

Finally, *United Aircraft Corporation* will demonstrate two versions of the Pratt & Whitney Aircraft Division's super-powerful J-57 twin-compressor turbojet—with and without afterburner—which powers the Boeing 707, the eight-jet Boeing B-52 bomber and a number of U.S. Air Force and U.S. Navy fighters. Other exhibits: cutaway models of the P. & W. R-1340 *Wasp* piston engine (for helicopters) and R-2800 *Double Wasp* (both manufactured by Canadian Pratt & Whitney Aircraft Ltd.); pneumatic turbojet starters, hydraulic pumps and synchro-phasers (Hamilton Standard): propeller accessories and test equipment by Kellstrom Tool Co. and M.B. Manufacturing Co. (for which United Aircraft holds the European sales rights). United Aircraft's extensive activity in helicopter production will be illustrated by a cutaway scale model (1 : 10) of the large Sikorsky S-58. Fitted with a 1,440 h.p. Wright R-1820 engine, this helicopter is used by the U.S. Army under the designation H-34 to carry 12 to 14 fully-equipped troops or 3,000 lbs. of supplies.

Sikorsky S-58 helicopter (Army designation H-34) for 12 to 14 fully-equipped troops: first deliveries of this helicopter, ordered in large numbers for the U.S. Army, were made in March 1955.

AN OUTSTANDING PYE PAIR



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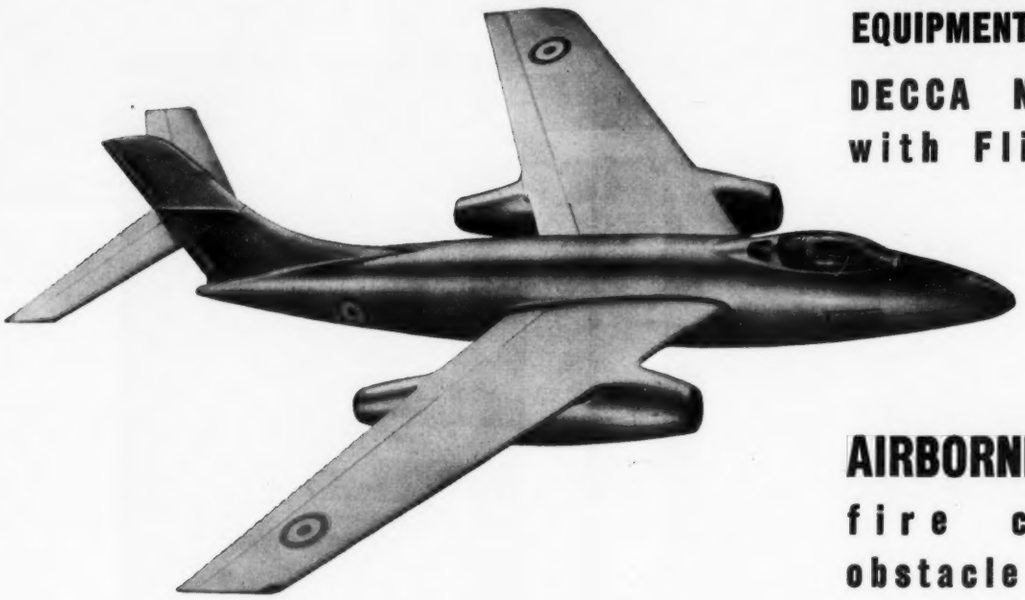

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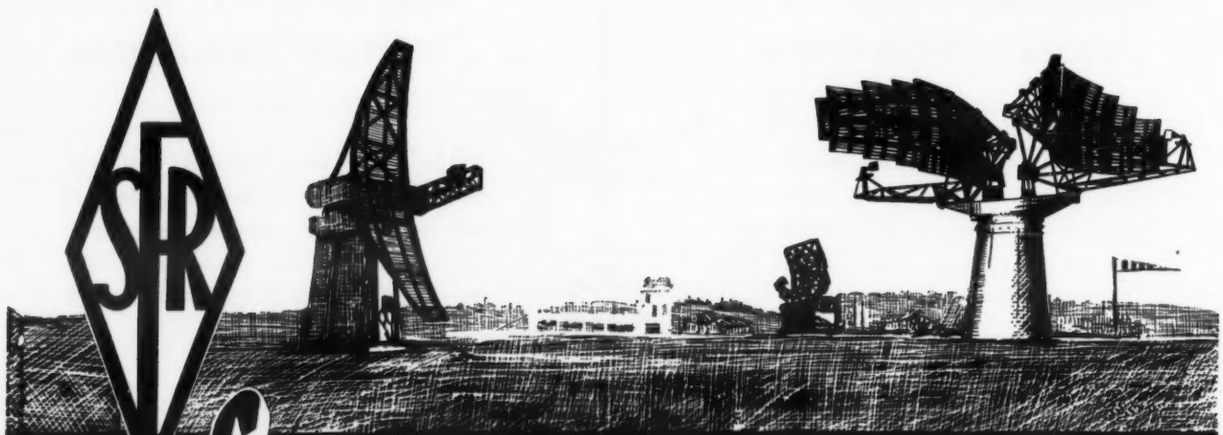

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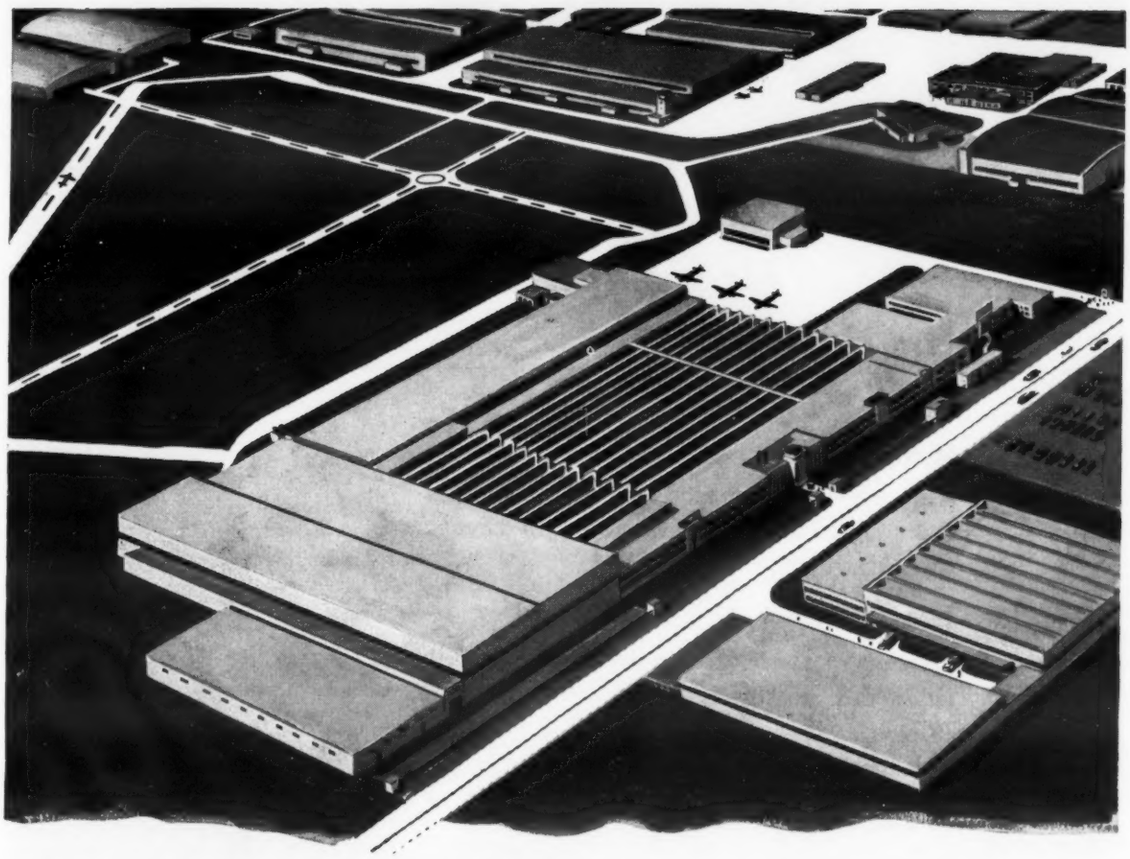

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MARK I

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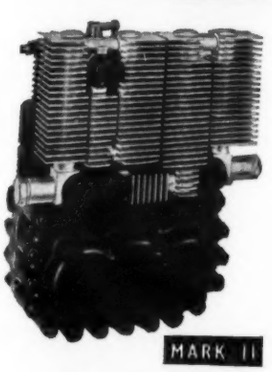
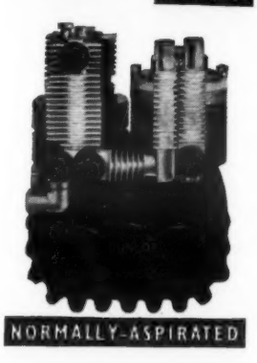


MARK II

NORMALLY-ASPIRATED

Expressly designed for piston and turbine engined aircraft that cannot supply the supercharge pressures required by the Mk. I and Mk. II compressors.



NORMALLY-ASPIRATED

	Working Pressure p.s.i.	r.p.m. (cruising)	Nominal Delivery cu-ft/min. Free Air	Boost Pressure p.s.i.
Mk. I	3000	3200	2½	30
Mk. II	3000	3200	4	20

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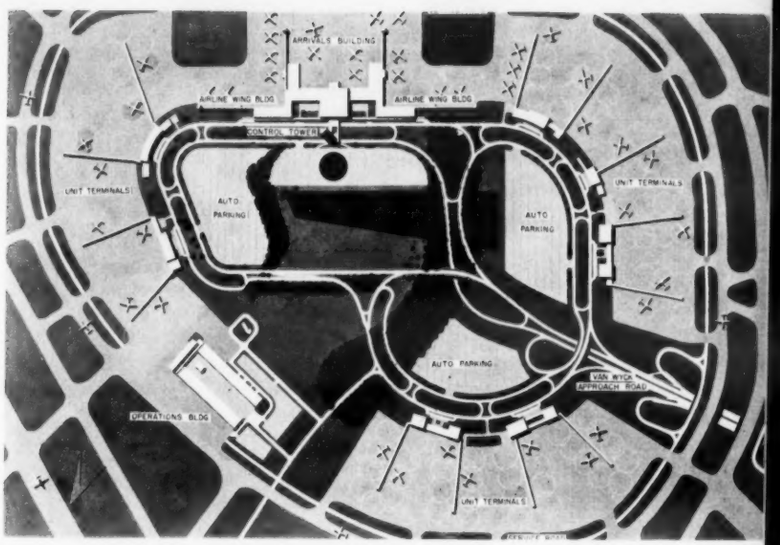
How Big is Big?

New York plans a "Terminal City" for Idlewild



Projected "Terminal City" at New York International Airport, Idlewild, with International Arrivals Building, two foreign-flag Airline Wing Buildings, seven American-flag airline terminal buildings, with a total of 140 aircraft positions.

"Superlatives," editorialized the staid *New York Times* a few weeks ago, "are the normal language to use in speaking of New York International Airport, Idlewild, with its 5,070 acres . . ."

The *Times* was commenting on an announcement by The Port of New York Authority—which is responsible for New York's four commercial airports—that a "terminal city" consisting of *ten* terminal buildings was to be built at Idlewild during the next five years at a cost of $ 60,000,000 . . . as the first step of an expansion plan which, it is unofficially estimated, will ultimately cost about $ 100,000,000.

The plan comes none too soon. In 1954 Idlewild handled 2,939,968 passengers and 100,000 aircraft movements with facilities for only 29 aircraft loading or unloading at the same time. By 1960 the airport is expected to handle more than 7,000,000 passengers a year, by 1965 more than 8,500,000.

The main characteristic of the new plan is its audacious departure from conventional terminal design featuring a single, large building which, in order to handle the same traffic for which the new terminal arrangement is projected, would have to be almost two miles long. Hence, for the new terminal the designers have adopted a policy of dispersal.

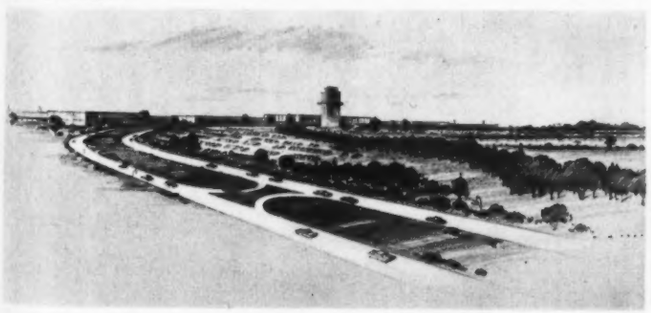
The ten terminal buildings—quite apart from hangars, operations buildings, etc.—will be situated within a 655-acre landscaped oval in the centre of the airport area and will include the following units:

1. A three-storey International Arrival Building with a floor area of 227,500 square feet to handle all incoming passengers requiring customs clearance. It will house Federal inspection services such as Health, Immigration and Customs, a huge penthouse restaurant and a luxurious cocktail lounge, a 3,300-foot partly-enclosed observation deck overlooking the airport, and various airline and consumer services. Construction is to start this year and be completed at the beginning of 1957.

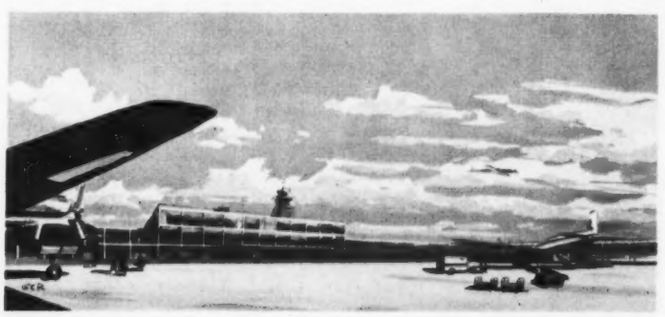
2. Two Airline Wing Buildings flanking the Arrival Building east and west, each 300 feet long and 80 feet wide and connected with the aircraft positions by two 500-foot two-storey arcades. They will provide 57,600 square feet of floor space in addition to the 54,000 square feet of arcades. The Airline Wing Buildings will house the departure facilities, ticket counters, lobbies and offices of twelve foreign-flag airlines—to wit: Aerolíneas Argentinas, Air France, British Overseas Airways, Iberia-Líneas Aéreas Españolas, El Al-Israel National Airlines, KLM-Royal Dutch Airlines, Linee Aeree Italiane, Linea Aeropostal Venezolana, Loftleidir-Icelandic Airline, Sabena-Belgian Air Lines, Scandinavian Airlines System and Swissair. A thirteenth occupant in the near future will no doubt be Deutsche Lufthansa. The two buildings are also to be completed early in 1957.

3. Seven individual airline terminals for American flag airlines: American Airlines (with 16 aircraft positions), Eastern Air Lines (16), National Airlines (8), Northwest Airlines (8), Pan American Airways (16), Trans World Airlines (16), and United Air Lines (16). Each sixteen-position unit will have a floor area of 105,000 square feet. Projecting from the terminals will be "fingers" giving access to the aircraft positions. Helicopters will land and take off near the outer ends of the fingers for airport-to-airport and airport-to-city traffic. Construction of the terminals will begin as soon as design plans are prepared and contracts let. Carriers will have the option of leasing the land from the Port Authority and financing their own construction, or else of leasing a complete Port Authority-financed terminal. The outward design of the terminals will be determined by the Authority to blend into the overall architectural pattern of the new project. Passengers who start or end their journeys at New York International Airport will thus go directly to the individual U.S. terminal of the airline they are using or directly—on domestic flights—from such a terminal to ground transportation. At present such passengers constitute 85 percent

A view of the passenger plaza in the centre of the terminal area, including one of the three parking lots.



International Arrivals Building at Idlewild, seen from the aircraft apron.



of those using the airport; 10 percent transfer from one flight to another on the same airline; while 5 percent transfer from one airline to another, for which purpose inter-terminal bus service and baggage transfer will be established.

The ten buildings—with a combined floor area of more than a million square feet—will be situated around an oval aircraft apron of 176 acres—certainly the largest in the world. They will provide a total of 140 aircraft positions, namely, 32 at the Arrival Building and the two adjacent Wing Buildings, 96 at the seven airline terminals plus possible accommodation for a further 12. This compares with 29 positions at Idlewild today, 18 at New York-La Guardia and 16 at Newark. Inside the oval will be a magnificent 160-acre plaza, a large "reflecting lagoon," three parking lots for a total of 6,000 cars, and a labyrinth of connecting roads.

The existing eleven-storey Control Tower, at present an ungainly steel structure, will be enclosed to harmonize with the general pattern and connected with the International Arrival Building by an elevated promenade.

The cost of the new terminal facilities will come—as stated—to a total of $ 60,000,000. Of this, $ 15,000,000 will go for the International Arrival and Airline Wing Buildings, $ 30,000,000 for the seven individual airline terminals, and $ 15,000,000 for roadways, taxiways, aprons, landscaping and utilities for the area. The length of the roads and taxiways to be built is particularly impressive: 7½ miles of 100-foot wide dual taxiways servicing the passenger terminal area, 10 miles of two-lane, 24-foot wide roads in the same area . . . Additional expansion already scheduled for the future includes a 200-to-300 room hotel outside the passenger station area for the use of passengers who prefer to wait out stopover time away from the airport or for persons from outside New York meeting or accompanying arriving or departing passengers.

Main entrance to International Arrivals Building (in background) with elevated promenade (foreground) and enclosed eleven-story control tower. Airline Wing Building East is at left of control tower.

Routine expansion work now in progress at Idlewild includes construction of new cargo buildings, fuel storage facilities, and a number of airline hangars.

So far as is discernible from the official reports, no immediate expansion is planned for the airport's runway structure. Altogether seven runways are available, five of which—including an instrument runway—are in regular use.

The new "Terminal City" plan will be completed in stages over a period of about five years. A sum of $ 2,000,000 has already been

Artist's conception of Idlewild "Terminal City".

allotted for final design plans, and construction is to start later this year. Money for the project will probably be raised through a new bond issue by the Port of New York Authority. All phases of the International Airport Terminal project are being worked out under the supervision of Fred M. Glass, the Authority's Director of Aviation, by the well-known firm of architects Skidmore, Owings and Merrill. Another famous architect, Wallace K. Harrison, creator of Rockefeller Center and the United Nations buildings in New York, is serving as design consultant and coordinator of exterior architecture of the various buildings.

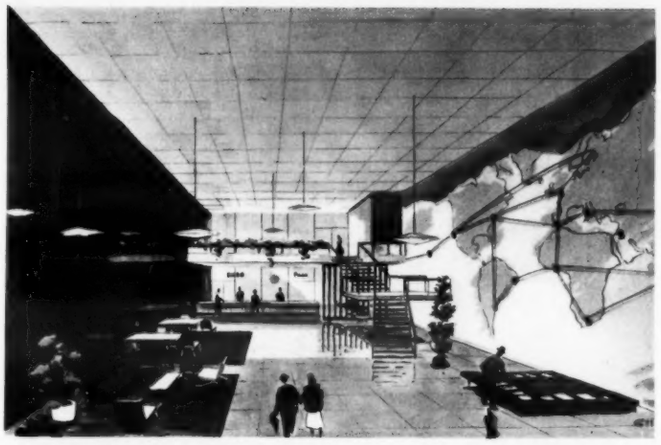
By 1960 Idlewild is to become the "most beautiful, efficient and functional" airport in the world—and, it is hoped, a paying proposition for the first time. It will then provide jobs for 16,500 people on an annual payroll of $ 82,000,000. Five years later, in 1965, its working strength will have increased to 18,500 people with a payroll of $ 100,000,000—nearly double the 10,162 airport employees earning $ 54,000,000 yearly at the airport today.

New York International Airport, Idlewild, is the major component of the Port Authority's regional system of four airports. Together with La Guardia Airport it was leased by the Authority from New York City in 1947 for a period of fifty years, i.e., until 1997—but an extension of the lease will no doubt be arranged when the time comes. In 1948 the Authority also leased Newark Airport, New Jersey, from the City of Newark for a similar fifty-year term. And in 1949 the Authority purchased, Teterboro Airport, New Jersey, for about $ 7,500,000, to complete its system for the New York-New Jersey metropolitan area.

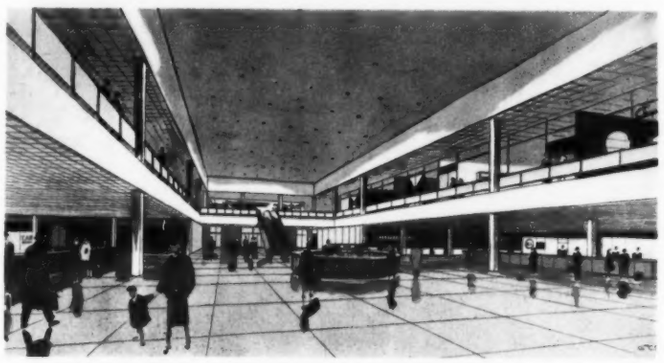
By 1965 the four airports will be handling a yearly total of 15,000,000 domestic passengers and 665,400,000 pounds of air cargo. Idlewild alone will be handling 6,750,000 domestic and 1,760,000 overseas passengers annually.

Idlewild will cope not only with overseas traffic but will also handle about half of the long-haul domestic traffic, a fourth of the short-haul domestic traffic, and a third of the domestic cargo traffic. La Guardia Airport, closer to the centre of Manhattan, will handle half of the short-haul domestic passenger flights and about ten percent of domestic cargo traffic, as well as an increased amount of corporate and private traffic. Newark Airport will deal with half of the domestic long-haul passenger traffic, a fourth of domestic short-haul and nearly two-thirds of domestic cargo traffic. Teterboro will specialize in corporate and private traffic as well as training activities.

How bis is big? Idlewild certainly will be.



A typical foreign-flag airline office and lobby in one of the Airline Wing Buildings of the projected Idlewild Terminal City.



Main lobby, International Arrivals Buildings, New York International Airport, Idlewild.

COMMUNIST CHINA's AIR BUILD-UP

The fact that Communist China has been building up its air strength on the Chinese mainland opposite the Matsu and Quemoy Islands and Formosa is no secret. On the coast of Fukien, near Amoy, directly across from Quemoy, the Communists have so far built five large, new airfields. They accommodate both fighter and bomber units, and American observers fear that in case of a Communist assault on the Matsus and Quemoy the Red Chinese would have local air superiority from the outset. Meanwhile, efforts are still going on to bring the U.S.A. and Red China together for cease-fire talks concerning the Formosa Strait.—Below are two of the very rare photographs available to the West of Red Chinese fighters and their pilots. *Left:* A line-up of Chinese MiG-15's, ready to taxi out to the runways of an air base on the East China Coast; note peculiar camouflage, auxiliary fuel tanks under wings. *Right:* Briefing the pilots.

Situation Report from Bonn

May 1955. — Subdued optimism. While Russia's surprise move on Austria, the West German Socialists' opposition to the Paris Agreements, and proposals for "third solutions" for rearmament do not simplify the implementation of Chancellor Adenauer's plans, it is unlikely that they will ultimately upset them.

The Federal Government's official "Bulletin" for April 26th, 1955, is clear: "The Federal Government stands by the Agreements . . . Third solutions for rearmament are rejected in Bonn government circles . . . The Federal Government rejects as dangerous and unrealistic all solutions to the German problem which might lead away from the Western defence community . . ."

Incidentally the next official article in the same issue of the "Bulletin" is entitled: "The East German Democratic Republic is not a legitimate State . . ."

This, too, is clear enough.

*

Meanwhile the Deutsche Lufthansa has made its first tentative steps, or rather, trial flights. To demonstrate the importance of this visible evidence of regained sovereignty, the Federal Chancellor personally received Lockheed Aircraft representatives and the members of the Board of the German flag carrier. The accompanying picture shows Lockheed Commercial Sales Director Leonard K. Schwartz presenting him with a gold-plated model of the *Super Constellation* on behalf of his President, Robert E. Gross.

But a slight chill has fallen over this enthusiasm. In April the "illegitimate" East German Republic presented the Federal Chancellor, his Transport Minister and the West German airline's Board with what the West Germans regard as an illegitimate Lufthansa offspring. A second "Deutsche Lufthansa" was founded in East Berlin, with home base at the hitherto Russian air base of Berlin-Schönefeld. However, the new airline cannot strictly be denied all recognition of legitimacy, since in addition to East German communes there were also other former Lufthansa shareholders and old Lufthansa property in East Germany which the West German Transport Minister appears to have overlooked in founding his airline in Cologne.

*

What progress is being made as regards the German air forces provided for within the framework of the Western defence community?

The office under Theodor Blank, who still bears the provisional title of "Security Delegate", goes on planning. No change can be made in the project for twelve mechanized divisions, as these are laid down in the Paris Agreements. Contacts with military and industrial experts from the United States, Britain, France, Italy and other N.A.T.O. countries are the order of the day. But none of the German officers who have so far come to the fore appear to be intimately acquainted with air force problems.

A gold-plated Lockheed *Super Constellation* for the Federal Chancellor. Left to right: Frank Fahle (Lockheed representative in Germany), Leonard K. Schwartz (Lockheed Commercial Sales Director), Federal Chancellor Adenauer, Captain Meuser (Lockheed representative for Europe), Dipl. Ing. Gerhard Höltje (Lufthansa Board member), Werner Kreipe (Ministerial Councillor at the Federal Transport Ministry).

Yet the air forces play a leading rôle in all armament or rearmament programmes—be it the American, British or Russian armament plans, or the French or Italian rearmament plans. Germany seems to be shying away from the concept of a new Luftwaffe, perhaps in part because the word "Luftwaffe" could be used only if the word "Wehrmacht" became acceptable again. Both terms still retain a certain odium, since they designate creations of the Third Reich. But they are at least clear.

Neither Theodor Blank, nor Generals Heusinger and Speidel, nor again Colonels Fett and Graf Kielmannsegg—and these are the names most often quoted today—can claim to be experts in military aviation. Agreement appears to have been reached on an apparently minor matter, which however may turn out to be far from minor: the uniform for all branches of the armed services is to be "stone-grey", the air forces being distinguished by rings on the sleeves similar to those in the Royal Air Force. This is a revealing decision, since in all other countries members of the air force and navy wear uniforms of a different colour from their army comrades.

A striking feature to the outsider is still the fact that the top military personalities in Bonn do not include a single name from the old German Luftwaffe. Former infantry and tank generals hold undisputed sway.

*

Conversations behind the scenes of the Bonn Parliament were centred, towards the end of April, on whether and how certain provisions of the Paris Agreements could be implemented. These permit West Germany to maintain troops outside N.A.T.O. for the purpose of purely home defence.

Behind this activity is a small group of obvious experts in the Blank Office, who, while rejecting the proposals of recently-dismissed Colonel Bogislav von Bonin, are urging that technical and personnel plans be made, as permitted under the Paris Agreements, for the *air defence of the Federal Republic*. What they have in mind is a programme spread over at least five years and calling initially for a wide-meshed radar network with permanent crews. In the course of time this network could also be extended for fighter control purposes.

The personnel required for such a programme and for the necessary ground defences could be found by setting up small professional units, later to be filled up from militia formations. Ultimately 450,000 men would be needed. At the same time, but independently of this programme to be implemented from defence resources, the Federal Minister of the Interior should finance an air raid warning service and the construction of air raid shelters. All these demands are supported by the argument that the risks incurred under the Paris Agreements would be unacceptable without reliable air observer network, air raid warning service and ground defences. A certain minimum air defence organization is simply indispensable . . .

Neither the Blank Office's nor the Federal Finance Minister's plans—though perhaps the Minister of the Interior—provide any funds for such a programme.

On the other hand, it is known that N.A.T.O. has set up a technical centre for Western European air defence in The Hague, Holland, and is preparing the creation of a Western European air raid warning system. Apart from this, all that the German public knows is that the first volunteers for the future land, air and naval forces will be called up later this year, but that it will take years effectively to set up the future German N.A.T.O. forces.

After its experience of the last war it is understandable that the German public's concern with questions of air defence should be great. Former Luftwaffe and air defence circles are therefore giving their attention to these problems and asking what Bonn's ideas are on the subject.

XXX

What's in the Air?*

AVIATION POLITICS

• Substantial increase in American guided missiles appropriations

The estimates for the 1955-56 fiscal year (beginning on July 1st, 1955) include the sum of approx. $ 923,000,000 for the production of U. S. guided missiles, or almost three times as much as the sum awarded by the Congress in 1954-55 ($ 345,000,000). Stressing the importance of research and development in this field, Assistant Secretary for Defense W.J. McNeil told the Senate Appropriations Sub-Committee that $ 500,000,000 had been spent on guided missiles during each of the last two years including sums carried over from previous budgets.

• European civil/military air traffic coordination

An international European committee to coordinate civil and military flying activities has been set up by N.A.T.O., in collaboration with I.C.A.O. Establishment of a coordination committee of this sort became indispensable in order to prevent interference by the steadily increasing flight operations of the N.A.T.O. air forces with the commercial airlines. The same subject was discussed in detail at the last I.A.T.A. Annual General Meeting in Paris in September 1954, when it was described as one of I.A.T.A.'s main problems. The danger has been found to be particularly great, for example, on the Paris-Brussels route, etc. The N.A.T.O. initiators of the plan count on the cooperation of I.C.A.O. and I.A.T.A. in Montreal and of other international organizations.

SERVICE AVIATION

• Exercise for Canberra jet bomber

R.A.F.'s Exercise "Sky High", held at the end of April under the N.A.T.O. training programme, for the first time used exclusively jet bombers. The exercise was designed primarily to practise the operation of the English Electric *Canberra* light jet bomber over Western Europe. "Enemy action" against the *Canberras* was provided by fighters of the 2nd and 4th Allied Tactical Air Forces in Germany and the Royal Norwegian Air Force.

• U.S. aircraft carrier Bois-Belleau to continue in French service

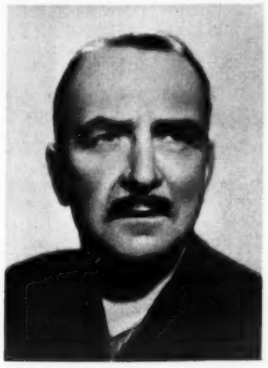
The United States Senate has approved a bill extending the period of loan of the 11,000-ton aircraft carrier *Bois-Belleau* to the French Navy until June 30th, 1958.

• New honour for Professor von Karman

The number of distinctions conferred on Professor Theodore von Karman, pioneer aerodynamicist and Chairman of N.A.T.O.'s Advisory Group for Aeronautical Research and Development, is constantly increasing: *Interavia's* Rome correspondent now reports from the Vatican City that Professor von Karman has been appointed a Member of the Papal Academy.

• Japanese defence plans

The Japanese Government's defence plans for 1955 provide for a strengthening of the Air Force by a total of 230 aircraft: 54 North American F-86 *Sabres,* 6 Curtiss C-46 *Commando* transports, 59 Lockheed T-33A jet trainers and 84 North American T-6G *Harvards* for basic training. In Japan itself 27 Beech T-34 trainers are to be built in addition. At present the three defence forces have a total of 417 aircraft: Air Force 147, Navy 49, Army 221.



Death of Louis Bréguet: Louis Bréguet, one of the pioneers of French aviation and internationally known aircraft manufacturer, died of a heart attack at his home near St. Germain, Paris, on May 4th, at the age of 75. Member of an old French-Swiss engineering family, Bréguet flew his first aircraft in 1907 and in 1911 founded the Ateliers d'Aviation Louis Bréguet, whose name achieved world fame in 1930 when Costes and Bellonte made the first non-stop east-west crossing of the Atlantic in the Bréguet single-engined biplane "Point d'Interrogation". The firm is continuing in Louis Bréguet's tradition under his successors, who include his son Pierre.

• Red China musters jet bombers

A "considerable number" of Russian-built Ilyushin Il-28 twin-jet bombers of the Red Chinese Air Force have been moved from North China and probably Manchuria to the Shanghai-Hangchow area—within range of Formosa and the U.S. 7th Fleet—according to Nationalist Chinese sources.—This redeployment is presumably what U.S. Secretary of State John Foster Dulles was referring to at a recent press conference on Formosan defence at Augusta, Ga.

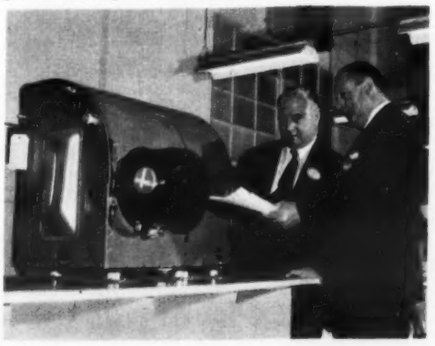
AIR TRANSPORTATION

• Second European air transport conference

The first conference on the coordination of European air transport held at Strasbourg in 1954 under the auspices of the Council of Europe and the International Civil Aviation Organization is to be followed by a second conference in the same city at the end of November 1955. Subjects for discussion include: reciprocal award of traffic rights

Gilfillan, Los Angeles, makers of electronic equipment and aircraft accessories, has granted *Houdaille-Hershey Corp.* of Detroit, exclusive manufacturing and sales rights to the Gilfillan Vari-flow high pressure pump for aircraft hydraulic equipment. Left to right: *C. S. Sorenson,* inventor and consultant to Houdaille-Hershey Corp.; *Ralph F. Peo,* President of Houdaille-Hershey Corp.; *A. Jennings Brown,* Vice-President of Gilfillan, Aircraft Division.

W. T. Mallock, Chairman and Managing Director of William Sugg & Co. Ltd., (left) and *Edmund T. Price,* President and General Manager of Solar Aircraft Co., have signed an agreement setting up the British firm of Sugg Solar Ltd. which will manufacture the Solar *Mars* gas turbine engine in Britain.



Air Marshal Sir Harry Broadhurst (left), Commander-in-Chief of the Second Allied Tactical Air Force, received a visit at his headquarters at R.A.F. Station Fassberg, Germany, from Chief of the Italian Air Staff General *Raffaelli* (right).

* Extract from *Interavia Air Letter,* daily international news digest in English, French and German. All rights reserved.

(for scheduled and non-scheduled services), exchange of flying equipment, helicopter operations, simplification of air traffic control methods, and economic questions.

● Intermingling of shipping and air transport interests

The French shipping line Chargeurs Réunis, who already have a controlling interest in Union Aéromaritime de Transport, one of France's major independent airlines, has acquired 60 % of the share capital of Aigle Azur. M. Sylvain Floirat will continue to act as President. The air fleet now available to the combined shipping-air transport undertaking comprises seven Douglas DC-6Bs, one Douglas DC-4, three Nord 2501s and nine *Herons*.

● Air travellers are good payers

Pan American World Airways' experience of the "pay later" scheme for air travel has been encouraging. During the scheme's first year P.A.A. booked additional business to the value of $ 4,200,000, and not a single passenger defaulted on payments. According to the Vice-President of the Beneficial Finance Co., which services the P.A.A. instalment plan, the record is significant "when considered that unlike the purchase of automobiles, TV sets or refrigerators, where the customer has tangible security that may be forfeited for non-payment, the P.A.A. plan is based solely on the customer's good name."

● Air-minded Australia

Roughly 2,000,000 persons travelled by air in Australia in 1954. The Commonwealth's total population is 9,000,000.

● Boeing jet transport by 1958?

The commercial transport version of the Boeing 707 *Stratotanker/Stratoliner* will "not be available to commercial airlines until 1958", Boeing Senior Vice-President Wellwood E. Beall told 150 officials of the United States major airports on April 26th.—This statement is contrary to the general view held in American airline and industrial circles that 1960 would be the earliest date for the advent of the jet commercial transport.—For example, Roy T. Hurley, Chairman and President of Curtiss-Wright Corp., recently told the company's General Meeting that Curtiss-Wright plans to continue piston engine production for the next eight to ten years, as jet-powered commercial transports would probably be much later to enter service than was generally assumed at present.—Donald W. Douglas, President of Douglas Aircraft Co., also told the Douglas General Meeting at the end of April that he expects both turboprop and turbojet transports to be in service by 1960. His company, he added, will build both types. "Since we cannot construct both at once, we are trying to determine now which to undertake first."

Grumman S2F-1 Sentinel anti-submarine aircraft with extensive sub-hunting equipment and rocket carriers underneath the wings. Picture shows the radome in extended position beneath the fuselage, used to detect and track surfaced submarines. The magnetic airborne detection boom projecting from the tail cone can detect and home onto submerged submarines.

● Igor Sikorsky on helicopter prospects

On a visit to London to receive the 1955 James Watt Medal from the Institution of Mechanical Engineers, Dr. Igor Sikorsky, Engineering Manager of Sikorsky Aircraft Division of United Aircraft Corp., told *Interavia's* London Editor that contrary to the generally prevailing view passenger aircraft would increase in size and would require still larger runways. Pure vertical take-off aircraft, he thought, would have only limited military application, as their development is likely to prove too complex and hazardous for civil use. He forecast a "vast field" of application for the helicopter and expressed his belief that 25-to-30-passenger commercial helicopters would be available for service in about three years (the civil version of the S-56 now in production for military use will carry 34 passengers).

● Lockheed missiles appointment

Lockheed Aircraft Corp. has appointed Dr. Louis N. Ridenour as Director of Program Development at its Missiles Systems Division, Van Nuys, Calif. Ridenour is well known for his World War II radar development work, has been a leading U.S. Air Force research scientist and has held key posts and research positions in industry as well as the academic world (University of Illinois, Massachusetts Institute of Technology).

French air transport figures for 1954

The following figures have been taken from the 1954 statistics for French airlines published by the French Ministry for Public Works, Transport and Travel (percentage increase over 1953 in brackets):

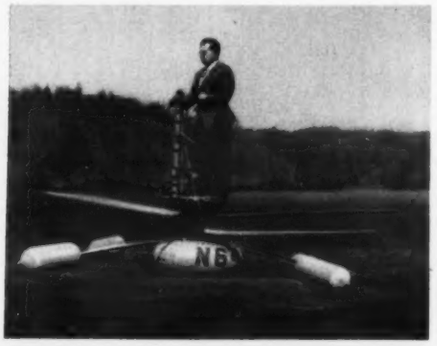
	Passengers	Freight (tonnes)	Mail (tonnes)	Km. flown (thousands)	Load factor %
Air France	1,526,767 (+ 17.5)	41,675.2 (+15.5)	11,084.4 (+ 25.1)	56,899.7 (+ 15.4)	68.1
Private companies I¹)	365,248 (+ 8.9)	10,790.3 (— 3.3)	982.8 (+ 74.2)	27,762.4 (—)	66.3
Private companies II²).	277,815 (+ 12.8)	28,000.1 (+ 8.6)	95.6 (—25.6)	8,900.7 (+ 68.2)	52.0

¹) Companies with headquarters in France or North Africa.
²) Companies with headquarters in Indo-China.

● Convair studying space vehicles

It has been confirmed that Convair is the first U.S. airframe company known to be undertaking a complete research programme for manned outer-space vehicles and to include in its studies the serious contemplation of interplanetary space ships. The project is headed by Krafft Ehricke, a German astrophysicist who was associated with the Peenemünde experiments in 1942, subsequently worked in the gas dynamics section of Redstone Arsenal in the United States and was employed by Bell Aircraft on rocket plane research.

Several firms in the United States are working on "flying platforms": the device recently announced by Hiller was developed for the Office of Naval Research. De Lackner Helicopters' DH-4 *Heli-Vector* is fitted with floats. The applications of devices of this kind are practically unlimited: sea rescue, short distance communication services, aerial photographic reconnaissance and artillery observation, etc.



FLYING EQUIPMENT

● The first of two *Boeing YC-97Js* ordered by the U.S. Air Force has begun flight testing at Boeing's Seattle Airfield. The YC-97J is a version of the *Stratofreighter* transport fitted with Pratt & Whitney T-34 turboprops with the object of testing these engines in flight and obtaining general flight data on turboprop-powered tankers and transports.

● The first production model of the *Lockheed C-130A Hercules* four-engined turboprop transport recently took off on its first flight at Lockheed's Marietta, Georgia, flight test centre. On this first

Lothar Zobel (69), Manager of Stuttgart Airport and co-founder of the German Airport Working Group, retires on June 30th, 1955.

flight take-off run was only 855 ft. (i.e., roughly nine times the length of the fuselage), while an even shorter distance was obtained for landing. These figures clearly show how useful the C-130A will be for the transport of troops and supplies in the fighting zone. With a gross weight of 54 tons, the *Hercules* is expected to carry loads of up to 20 tons. Chief Test Pilot B.A. (Bud) Martin reports it as very easy to fly; the unusually good rate of climb is also striking.

● More than 150 *Fairchild C-123* twin-engined assault transports are on order for the U.S. Air Force's transport units.

● The U.S. Air Force is testing a *delta-wing target aircraft;* leading edge sweep approx. 55—60 degrees; designed for towing speeds of more than 600 m.p.h.

● A development of the *Bristol Britannia* with four Bristol BE-25 propeller turbines is expected to be ready by about 1960. In order to take full advantage of the increased engine power, a new wing of lower thickness ratio, design of which has already been begun, is planned. The cruising speed of approx. 500 m.p.h. projected for this *Britannia* version will necessitate use of special high-speed propellers. To improve controllability at low speeds a boundary layer blower system is to be fitted.—Range of the BE.25 equipped *Britannia* is given as 6,000 miles.

POWER PLANT AND ACCESSORIES

● *Société des Moteurs Salmson,* of Billancourt, France, recently announced completion of works tests on the 260 h.p. *Salmson 8 AS 04-A* 8-cylinder engine (fitted in Nord 3200 and Farman *Monitor II*). Mention is also made for the first time of two small air-cooled engines (for auxiliary drive etc.), the 100 h.p. *Salmson 4 AH* and the 145 h.p. *Salmson 6 AH.* Salmson also plan to export the 220 h.p. *Salmson 9 NH 0-2* nine-cylinder radial engine developed for use in the SE.3120 *Alouette I* helicopter, since large-scale production of the SE.3120 has been abandoned for that of the turbine-powered SE.3130 *Alouette II.*

● *General Electric Co.,* of Schenectady, New York, has officially announced for the first time that the *I-73* axial compressor turbojet is now in production. Thrust of the present J-73 version is given as 9,000 lbs. without thrust increasing devices. The J-73, fitted for example in the North American F-86H *Sabre* fighter-bomber, has a 12-stage compresssor, annular combustion chamber and 2-stage turbine.

"Believe it or not, I have been in a helicopter" . . . The first U.S. Marine Aircraft Wing stationed in South Korea held open house for the Korean villagers.

● The *Pratt & Whitney J-75* turbojet of more than 15,000 lbs. s.t. is about to begin flight testing.

● *Turboméca* has announced first details of two new turbojet engines to be exhibited at the 21st Paris Aircraft Show:

The *Gourdon* of 1,460 lbs. take-off static thrust for a consumption of 1,480 lbs. per hour; max. continuous power 1,150 lbs. at 1,110 lbs. per hour; dry weight 378 lbs.

Soulor by-pass engine of 700 lbs. take-off static thrust for a consumption of 560 lbs. per hour; max. continuous power 595 lbs. at 462 lbs. per hour consumption; dry weight 308 lbs.

● *Ottico Meccanica Italiana,* Rome, has developed an *aerial camera* on which the co-ordinates of the "Nadir point" are directly marked on the film by a process designed by Engineer Umberto Nistri. The new method of triangulation ("Metodo Nistri a due assi primari giroscopici") is being tested by the O.E.E.P.E. (Organisation Européenne d'Etudes Photogrammétriques Expérimentales).

● *Computing Devices of Canada Ltd.,* of Ottawa, have developed an electro-mechanical navigation computor for homing onto fixed targets (airfields, cities, enemy ground targets, etc.).

● A *C-Band airborne storm-warning radar* (wavelength 5.5 cm.) is offered for the first time for touring and executive aircraft. The equipment, designated AVQ-10, has been developed by RCA, and the *AiResearch Aviation Service Division* of The Garrett Corp. holds the sales rights.

EXHIBITIONS

● An *international air meeting* and a historical *aviation exhibition* will be held at Geneva-Cointrin Airport from June 24th to July 17th, 1955 under the patronage of the Aero Club of Switzerland and Avia. The exhibition (June 24th to July 17th) will cover civil and military aircraft, engines and equipment items from past and present. International participants will take part in the air meeting on June 25th and 26th, at which aircraft not only from Western Europe and the United States but also from Eastern Europe are expected.

Admiral Emilio Ferreri, Chief of the Italian Naval Staff, has been appointed by the members of Western European Union as head of the W. E. U. Arms Control Committee. In his 61st year, Admiral Ferreri is by no means unknown to West European capitals: before World War II he was Italian Naval Attaché in Paris and Brussels. He was appointed Chief of the Naval Staff in 1948.

● **Canada's International Air Show**

The Aviation Section of the Eighth Canadian International Trade Fair, to be held in Toronto from May 30th to June 10th, 1955, will be bigger and more comprehensive than ever before. Exhibitors will include airframe, engine and accessories manufacturers from Canada, Britain, the United States and Czechoslovakia, as well as aviation authorities, airlines and aero clubs from throughout the world. An international flying display will be held on June 4th.

General Electric J-73 jet engine of 9,000 lbs. static thrust without thrust increasing devices. – Length 148 ins., over-all diameter 36.75 ins.

U.S. Navy P. T. boat being towed by a Piasecki H-21 helicopter. These tests open up new possibilities for the U.S. Navy's rescue and salvage service.

The Martin P5M *Marlin* flying-boat in the foreground prepares to refuel from the submarine oiler *Guavina*.

Sub Helps Flying-Boat

Since before but especially since the war sceptics have predicted the end of the flying-boat as a military weapon or a commercial transport vehicle. The military flying-boat has refused to die, however, and today the U.S. Navy, for one, is showing increasing interest in its survival.

This change in attitude is due chiefly to the renewed appreciation of the flying-boat's flexibility, its independence of easily destroyed air bases and the availability of suitable stretches of water in every part of the world—coupled with the important fact that post-war advances in flying-boat design (new hull shapes, hydroskis, etc.) have brought the aerodynamic efficiency virtually up to par with that of the landplane. The consequence is that the U.S. Navy is now again experimenting with the water-based interceptor (Convair *Sea Dart*) as well as with patrol-bomber and even jet-propelled bomber flying-boats (Martin XP6M *Seamaster*).

The Navy has now added a new twist to its flying-boat technique in its search for even greater flexibility for its flying-boats. Earlier this year it conducted successful tests in refuelling flying-boats from submarine tankers. The submarine took the seaplane, a piston-engined, radar-equipped Martin P5M *Marlin,* in tow and refuelled it—according to the Navy—by methods "combining those of refuelling surface ships in movement and aircraft in flight."

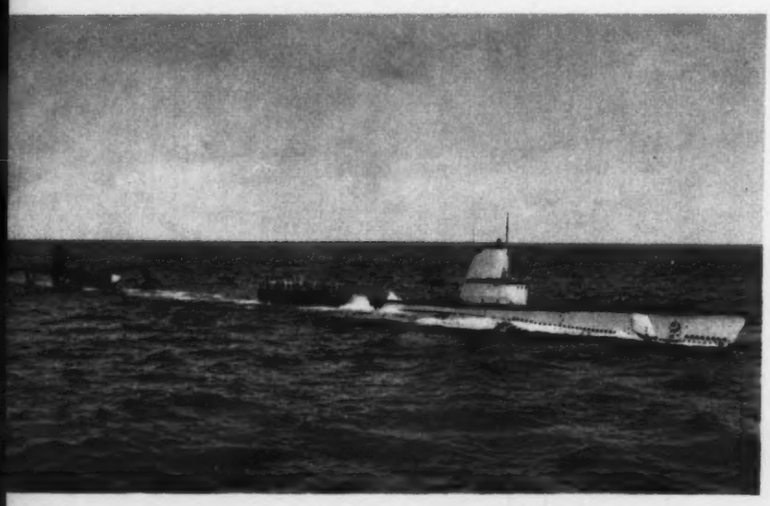
Naval observers state that jet-propelled flying-boats, refuelled by rendez-vous from a submarine at practically any remote but suitable spot in the world, could become an important factor as a strategic offensive weapon—a rôle hitherto reserved exclusively for the U.S. Air Force. Others regard the seaplane-submarine combination as a future adjunct of carrier forces for hit-and-run tactics against special enemy targets important enough to justify the use of an atomic bomb.

Already, however, the Navy is looking forward to the next step in strategic seaplane development—the atomic-powered flying-boat (as intimated by *Interavia* in its issue for January 1955, page 46). Mid-February reports from Washington state that development of such a type was "encouraging", though highly secret, but that one factor favouring the atom-powered seaplane over the atom-powered landplane is the immersion of the flying-boat in water which aids in solving the problem of radiation shielding of the power plant.

The refuelling tests—pictures of which are shown on these pages—took place off San Juan, Puerto Rico in the first week of February. The refuelling vessel was the submarine oiler SSO 362 *Guavina,* originally of the 2,425-ton (submerged) *Balao* class. An atom-powered submarine of the 2,500-ton SSN 571 *Nautilus* type would, of course, be even more efficient as a tanker vessel . . .

(continued on p. 441)

Refuelling is in progress.



The U. S. Navy submarine rescue vessel RS6 stands by as *Guavina* takes the Martin *Marlin* in tow.

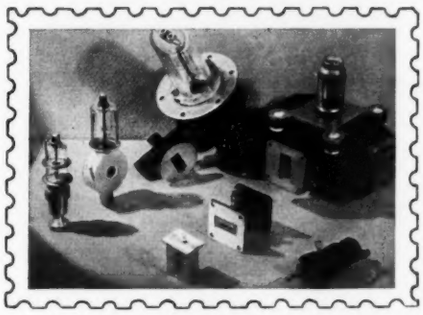
Cie FRANÇAISE THOMSON-HOUSTON

IN THE FRONT RANK OF EUROPEAN

ELECTRONIC MANUFACTURERS

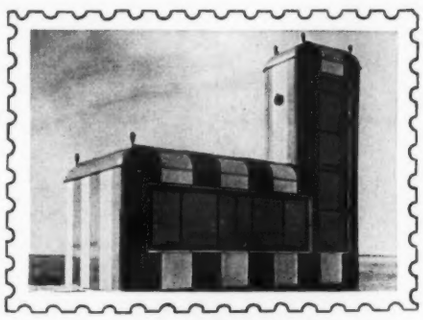
VAPOTRONS

CFTH



VHF TUBES

PORTABLE TRANSMITTER-RECEIVERS



G.C.A. EQUIPMENT

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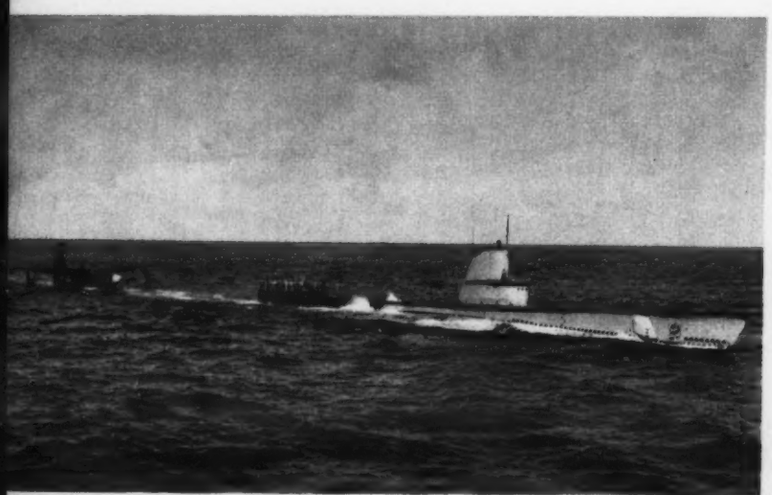

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Cie FRANÇAISE THOMSON-HOUSTON

IN THE FRONT RANK OF EUROPEAN

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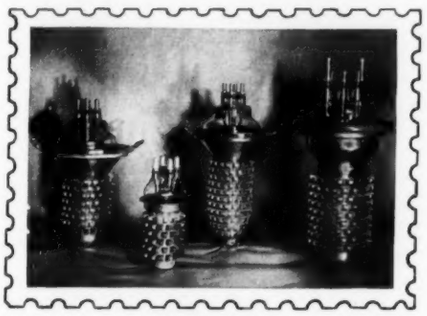
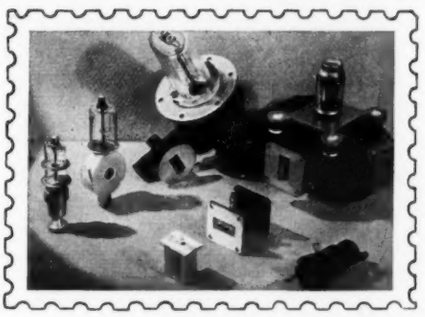


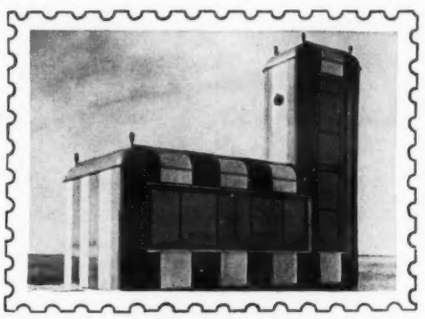
VAPOTRONS

CFTH



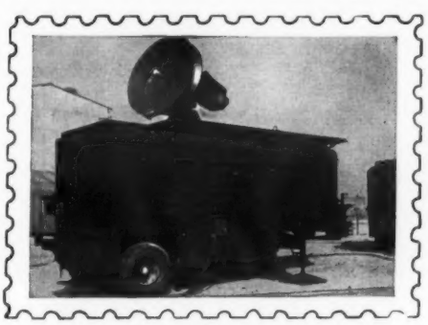
VHF TUBES

PORTABLE TRANSMITTER-RECEIVERS



G.C.A. EQUIPMENT

RADIO COMMUNICATIONS



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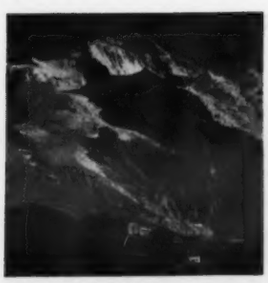
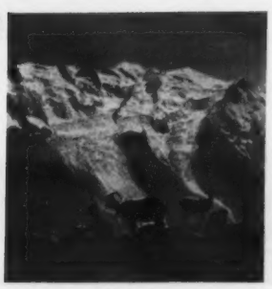
VALAIS



BERNESE OBERLAND

FRENCH ALPS



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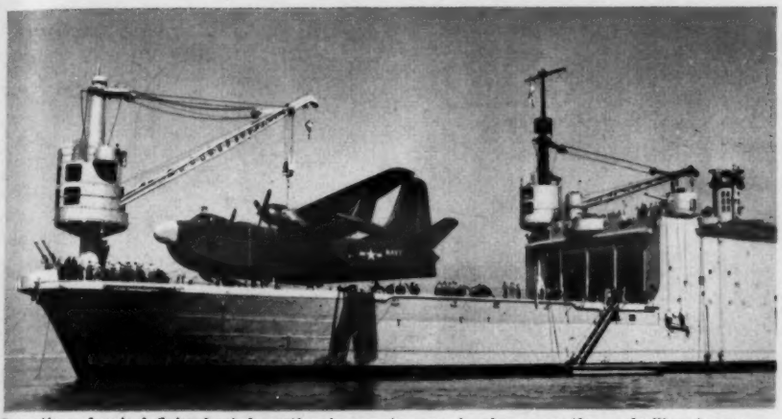
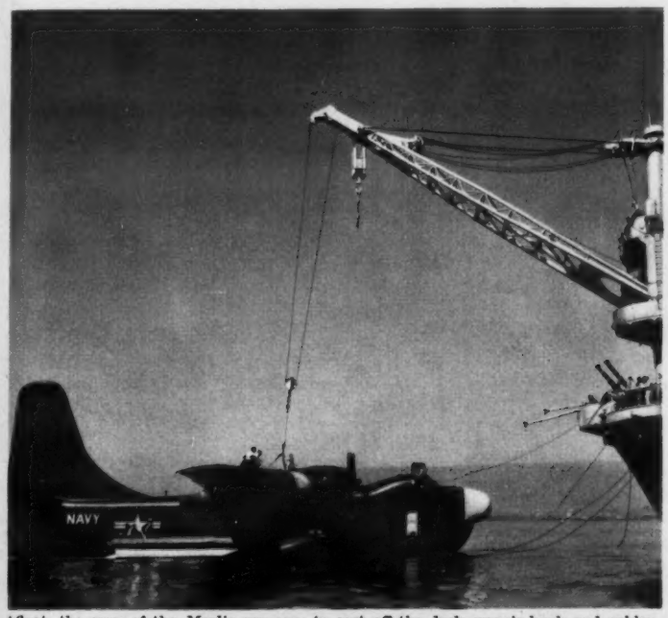
FLYING BOAT MAINTENANCE AT SEA



Operation of patrol flying-boat formation in remote areas involves more than refuelling, however. Seaplane tenders like the 15,000-ton AV-13 *Salisbury Sound* take care of inspection and maintenance.

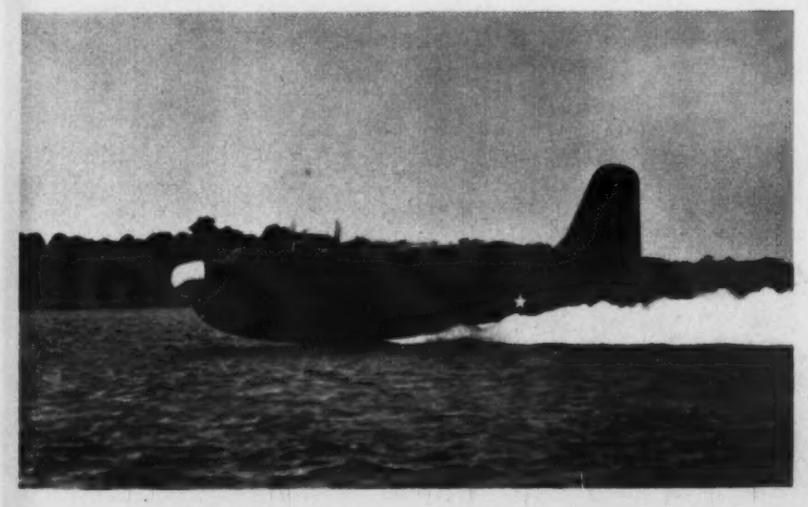
Maintenance completed. A crane swings the Martin P5M *Marlin* outboard and lowers it gently into the water.



Afloat, the crew of the *Marlin* prepares to cast off the deck crane's hook and cables.

While a boat from USS *Salisbury Sound* disengages the remaining guide lines, the crew of the *Marlin* prepare for take-off.

The P5M takes off in a cloud of spray.



No runways needed! Seven P5M *Marlin* patrol bombers at anchor in Buckner Bay, Okinawa.

P-16

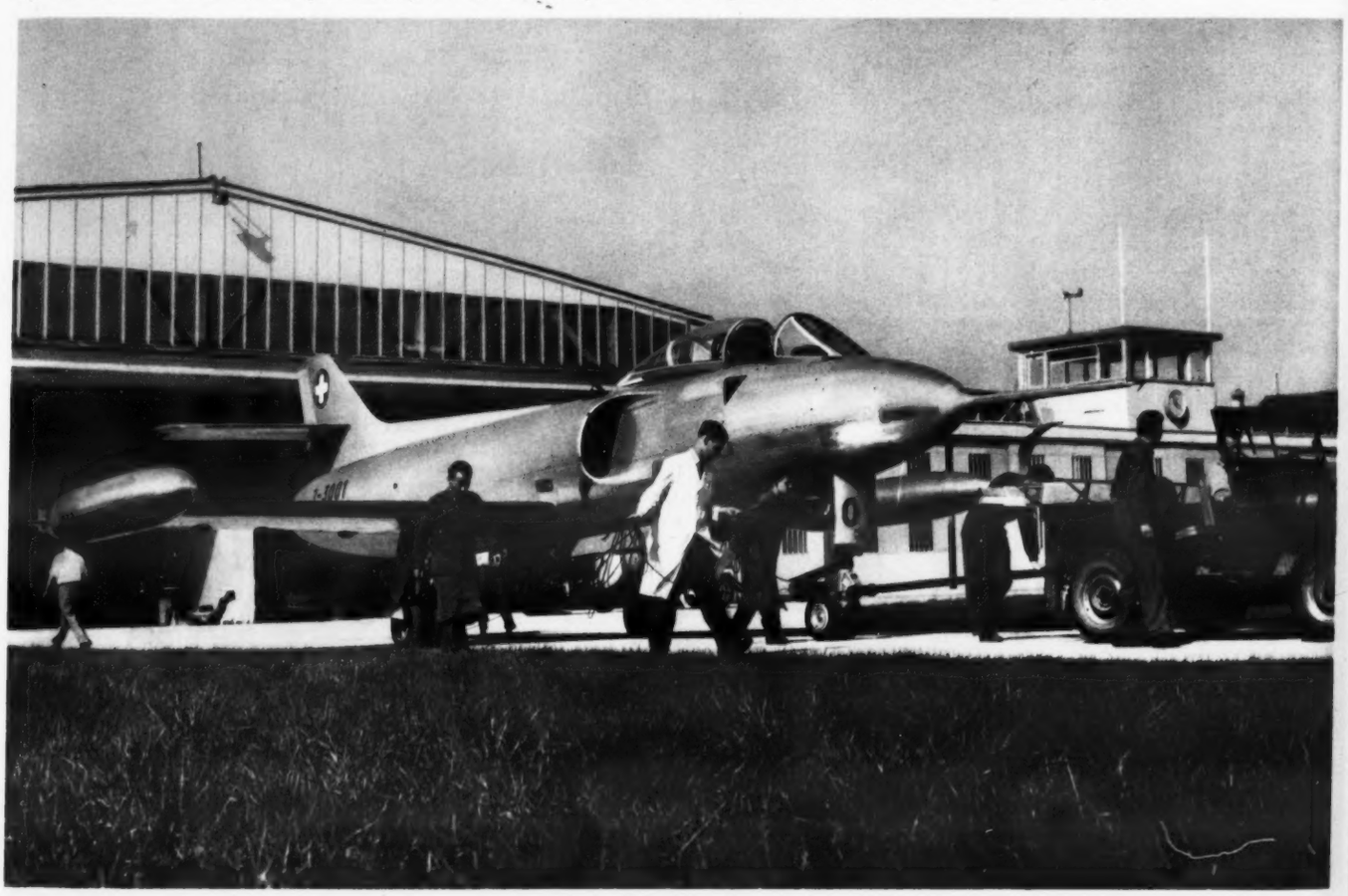
A Swiss Jet-Powered Combat Aircraft

Flug- und Fahrzeugwerke A.G., Altenrhein, have for some time been building two prototypes of a jet-powered fighter and ground attack aircraft, designated the P-16. The first prototype has now been completed and began flight testing on April 28th.

Although no details may yet be published, it is known that the P-16 is powered by an Armstrong Siddeley *Sapphire* axial-compressor turbojet (8,000 lbs. plus s. t.) and is to be heavily armed (presumably cannon in the nose, rocket projectiles, bombs and napalm containers).

As regards performance, the P-16 has been designed to suit the topographical conditions of Swiss air bases; it will take-off and land on short runways, have relatively low approach speed and good climb and high altitude performance, and should also reach adequate top speeds.

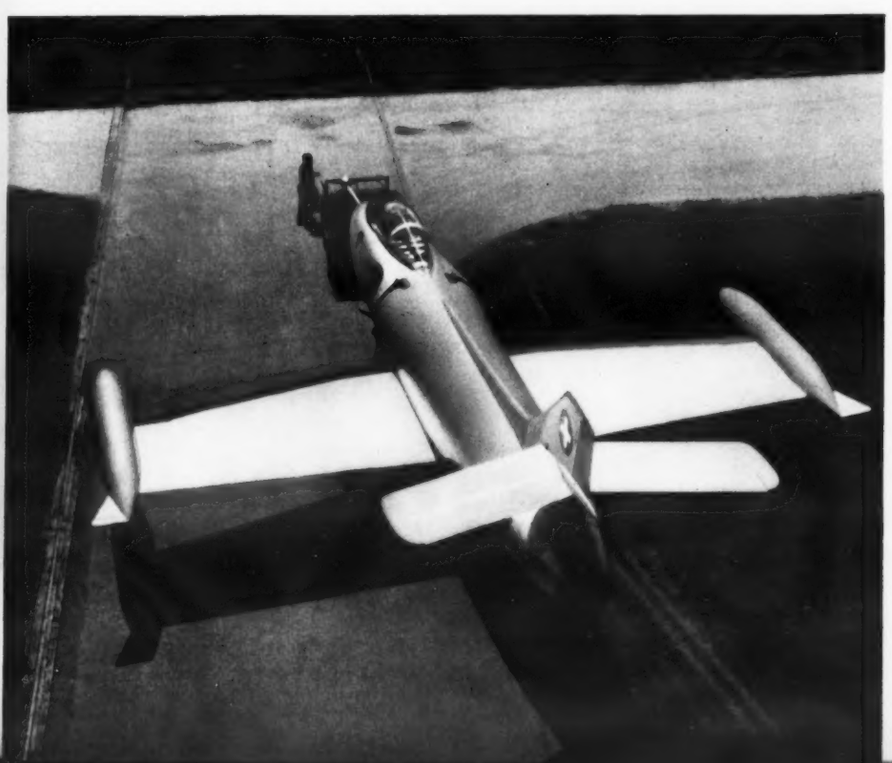
The P-16 being rolled out of the hangar for one of its first flights. The single-seat type is evidently equipped with an ejection seat and carries auxiliary fuel tanks at the wing tips. The air intake recalls in some respects the *Swift* with *Avon* axial-compressor jet. The engine used, however, is an Armstrong Siddeley *Sapphire*.



The ailerons can be drooped to increase the landing flap area. The relatively long-legged nose-wheel undercarriage has twin wheels on all units; main undercarriage units are retracted inwards into the wing roots, nose unit into the fuselage.

Leading figures connected with P-16 development (top to bottom): *Dr. Claudio Caroni*, President and Board Representative of Flug- und Fahrzeugwerke Altenrhein. – Works Manager *Otto Eitel* (left) and *Dr.-Ing. Hans L. Studer* (right); the latter is project engineer for the P-16. – The Pilot, *Lieutenant Häfliger* (left), of the Swiss Federal Military Department, before the first flight.

The straight wing of relatively large chord (apparently without lift-increasing devices at the leading edge) should ensure the required take-off and landing qualities, a relatively low landing speed and good high-altitude qualities. The slightly swept horizontal tailplane has a constant chord and large-area control surfaces; the whole tailplane is also evidently adjustable.



EQUIPMENT ROUND-UP

• Light-weight ejection seat

Chance Vought Aircraft Inc., of Dallas, Texas, has developed a simplified ejection seat weighing only 30 lbs. and based on concepts used in the Douglas A4D seat. Picture shows the new seat (right) alongside the standard 130-lb. model used in U.S. Navy jet fighters. The substantial weight saving was obtained, for example, by eliminating the foot rests and the tilt and forward-back adjustments provided in old seats, and by placing the guide rails for ejection in the cabin wall. Like the standard models, the new seat is operated simply by pulling down the face curtain. Shoulder and lap harnesses are released automatically as soon as the seat reaches the top of the guide rails.

• Pressure ratio indicator for jet engines

Hitherto jet engine performance has been determined from the turbine speed, but the military authorities have for some time been looking for a more reliable method. *Kollsman Instrument Corporation,* of Elmhurst, New York, has now designed a pressure ratio indicator which shows the ratio between the air inlet pressure (in front of the compressor) and the pressure at the tail-pipe and hence provides a reliable check of engine thrust.—The method offers the following advatages, in addition to greater accuracy: 1—when running up the engine before take-off the pilot can determine from the indicated pressure ratio (after making allowance for ambient air temperature by means of the hand-set temperature index) whether the maximum thrust for the airport altitude and atmospheric pressure is available; 2—to obtain optimum performance during climb and cruise, the pilot need merely hold a given reading of pressure ratio.—The Pressure Ratio Indicator is available in two basic types, a direct reading unit for mounting in the cockpit, necessitating relatively long tubing, and a remote system with the basic measuring mechanism mounted near the engine (lower picture), so that readings have to be transmitted to the dial in the cockpit (upper picture). The new system has been tested at Wright Air Force Base and ordered by McDonnell Aircraft Corporation for the F-101 *Voodoo.*

• A fully automatic fire control system for the F-86K *Sabre's* 20-mm cannon is being made at *North American Aviation's* Downey plant. The system, known as MG-4, is to be fitted in all F-86K models produced by North American in Los Angeles and by Fiat in Turin. — It gives the pilot information enabling him to locate airborne targets, select a particular target and fly an accurate lead-pursuit attack course. It indicates the range to the target and the suggested "pull-out" time. The pilot has a choice of several operating methods, details of which, however, have not been revealed. — The MG-4 is also combined with two navigation facilities, beacon interrogation and ground mapping. The system interrogates ground beacons and receives a coded response which is displayed on the pilot's radar screen, complete with azimuth and range information.

• 8-mm radar for airfield surface movement indication

The new control tower at London Airport has been equipped with a radar system, designed by Decca Radar Ltd., for airfield surface movement indication, which works on the unusually high frequency of approx. 34,000 mc/s, i.e. in the 8 mm wave band (so-called Q-band). In combination with a pulse duration of only 0.05 microseconds, this high frequency gives a radar image of exceptional accuracy, so that not only runways, taxiways and aircraft, but also small vehicles can be seen with adequate discrimination. — The 6-ft. transmitting and receiving aerial rotates 20 to 24 times a minute and scans the surrounding terrain with a beam $^3/_4{}^o$ wide and 14° high. The Decca equipment at London Airport has two displays, one for the Ground Movements Control Officer, and the second for use in monitoring take-off and checking outbound traffic. A third display can be added if required. Ranges of 0.5, 1, 3 and 10 miles can be set by means of a switch, and are shown on a cathode ray tube 12 ins. in diameter.—Technical data: wavelength: 8.69—8.83 mm; pulse peak power 12—15 kW; pulse duration 0.05 μsec; recurrence rate approx. 4,000 per second; range accuracy better than 2%; bearing accuracy $\pm$ 0.5°; power consumption approx. 2 kW; weight of aerial array with turning gear 500 lbs.

• Magnetometer for aircraft use

Hycon Aerial Surveys, of Pasadena, California, has acquired world rights to a magnetometer designed by Dr. Russell H. Varian, co-inventor of the Klystron tube. — The measuring element resembles a small bomb and is trailed behind the aircraft on a 30-ft. cable. Essentially the Varian magnetometer consists of a jar of water within a particularly sensitive electric coil. Every slight variation in the earth's magnetic field produces a reaction in the water's hydrogen nuclei, which is recorded by the coil and transmitted to the evaluating unit in the aircraft.

• The CE 91 VHF R/T transmitter for airport operation (frequency range 100-156 mc/s) is made by *Ekco Electronics Ltd.*, of Southend-on-Sea, Essex. Operation and frequency selection are by means of a nine-position switch and six calibrated controls (covered in the picture).

• A directional gyroscope that performs with high accuracy under extreme operating conditions of vibration, temperature and acceleration (up to 30 g) is offered by *Gyromechanisms Inc.*, of Halesite, New York. The Model 45,000 is particularly suitable for installation in guided missiles.

• A sound-proofed engine test bed with turbo-dynamometer is being tested at *Trans World Airlines'* Kansas City maintenance centre. Supplied by *Clayton Manufacturing Company*, of El Monte, California, the equipment is said to cost only half as much as the test beds hitherto in use by the airlines. A turbo-dynamometer (to measure power and brake the engine), a cooling blower for the test engine and a shaft with floating bearing are arranged one behind the other in a sound-proofed tubular housing. All control rods and conduits are connected via a quick-release unit to the control room, so that two men can replace one engine by another in ten to fifteen minutes.—Four more test beds of the same type, together with control rooms and assembly equipment, are to be set up at T.W.A.'s premises in Kansas City this autumn (total cost $ 1,400,000).

The Mind of Mr. Reader...

European Air Transport Cooperation

Sir,

... I have read with great interest your constructive leading article on air transport (*Interavia,* April 1955) and, if I may say so, it is very timely and also a valuable corrective of certain current misconceptions. I have only one comment. I do not think the Strasbourg Conference failed for lack of preparation. It failed primarily because of the virtual impossibility, at this stage, of reconciling the views of two quite extreme schools of thought on this subject. We in the United Kingdom pursued the middle course, not so much from tradition and habit, but as a possible means of bridging the gap between these two schools of thought and, at the same time, in the attempt to make some progress in removing some of the worst obstacles to European air transport development.

... I read *Interavia* always with interest ...

London. (Sir) W.C.G. Cribbett, K.B.E., C.M.G., Deputy Secretary Ministry of Transport and Civil Aviation

• As Conference Delegate Sir George Cribbett points out, there were indeed two schools of thought at the 1954 Strasbourg meeting: the Scandinavian delegates (Swedes, Norwegians, Danes), seconded by the Dutch and Luxemburg representatives, proposed a multilateral agreement granting full Fifth Freedom rights in Europe for two years. The British endeavoured to find a middle road, with the support of the French, Italians, Germans and, to some extent, the Spaniards, by arguing that the Conference should restrict itself to the task of achieving better direct co-operation between the authorities of the various countries and the airlines and to a liberalization of cargo traffic. — Ed.

Ice-water Imperialism

Sir,

... Your February issue on "Ice-water Imperialism" is as excellent as all the others ... My compliments on your ability to provide an understanding of aeronautics even to a complete outsider like myself.

A small error has occurred in your "Brief History of Polar Flying". You state that in 1935 Ellsworth and Balchen flew non-stop across the Antarctic Continent. In reality Ellsworth took along the American Hollick Kenyon as the pilot and made a total of four intermediate landings. At the third camp he was even held up for as long as eight days by storms ...

I assume that you are at least as familiar with these details as I am, but in the heat of battle it has been known to happen that Grandpa was the eldest of the family ...

Zurich, Switzerland. Robert Kreidler

Sir,

We, at Piasecki, were most interested in reading your article, "Mounting Guard at the Pole" (February 1955)... We were, however, disappointed that we had not gotten to you information on our H-21 helicopters which are being operated at various points in the Northern areas by U.S. Air Force and Royal Canadian Air Force Transport Squadrons.

The most important of this work is the supply of radar sites with material and supplies, particularly during the ice break-up period and just prior to the freezing of water areas adjacent to the sites.

H-21 helicopters are now supplying present sites in the Mid-Canada Line, Labrador area, and are soon to be active in the Dew Line, or, as called out on your map, the Distant Early Warning Line.

Morton, Pa., U.S.A. H.S. Tremper, Director of Public Relations, Piasecki Helicopter Corp.

• For Piasecki H-21 in Arctic action, see photo. — Ed.

Fräuleins, Girls, Demoiselles

Sir,

In your article entitled "After the Ratification by the German Parliament" (*Interavia,* April 1955) the designation of the German air hostesses as "Fräuleins" must be regarded as an insult to German womanhood.

This aberration is all the more regrettable inasmuch as it is not a case of an excusable lapse but, as is clearly denoted by the quotes bracketing the term, one of intentional diffamation.

I consider it high time to forget the regrettable phenomena of ... Germany's most painful years and to desist from such diffamation of a respected and honoured feminine profession.

In my opinion this will not be the only letter you will receive in protest against this vilification of German womanhood.

Brunswick, Germany. Robert Ehlers Oberregierungsbaurat z. Wv.

• INTERAVIA, flabbergasted at having stumbled over several German girls at once, assures Reader Ehlers that his letter was the only such phenomenon that arrived in the postbag in this connection. It also called in its expert on feminine questions, Esmeralda, its Favourite Air Hostess, to consult her on this grave problem. Sex, said Esmeralda, need not always raise its ugly head. Especially not in this case where the term "Fräulein" was used in the sense it had originally. "Fräulein", explains our Air Hostess, "means to me the same as Miss, Signorina, Fröken, Senorita, or Demoiselle—in other words, an unmarried feminine human being with a swell shape and habitually wearing a skirt". — Ed.

Brickbats and Bouquets

Sir,

... I certainly enjoyed reading this (April) issue as I enjoy reading every issue of *Interavia.* I should like to compliment you particularly on the excellent reproduction of illustrations in your magazine.

Ottawa, Ont., Canada. (Hon.) Ralph Campney Minister of National Defence

Sir,

In your issue No. 3 on page 191, you make reference to Bendix Aviation. I have to call your attention to the fact that Bendix Aviation Corporation is definitely not a part of any other organization, especially household appliances.

It is true that Bendix Aviation developed the original Bendix Washer, Ironer and Dryer but these products were sold to the Bendix Home Appliance Corporation who is now owned by Avco Manufacturing Company. Bendix Aviation has no connection with Avco in any way.

From the above you can readily see that Bendix Aviation Corporation is not "in turn only part—though a major one" of any other organization.

We do have many irons in the fire but not in the consumer field.

New York, N.Y., U.S.A.

A. E. Distelhurst Manager of Advertising and Sales Promotion, Bendix International, Division of Bendix Aviation Corp.

Sir,

Enclosed is my year's subscription order to *Interavia.* I saw a copy of your magazine in the Air Force Reserve Officer Training Corps Day Room and was very much pleased by it. I also asked one of our "Tac" officers about it and he replied that *Interavia* was the most complete magazine of its kind that he had seen.

Athens, Georgia, U.S.A.

Emmet J. Bondurant

Sir,

I feel it is my duty to inform you that in your April edition of *Interavia* the photograph on page 260 of a *Starfire* taking off from inside a hangar is a fake. The reason why I happen to know it is a fake is that the English Sunday newspaper "Sunday Pictorial" also produced the picture one week. The next week an announcement was made in the paper that the photograph was a fake. The reason given was that the photographer who took the photograph of a *Starfire* taxiing out of a hangar blurred his photograph as shown in your picture. So that, while your picture shows a *Starfire* flying out of a hangar, it really depicts a blurred photograph of a *Starfire* taxiing out of a hangar.

Watford, Herts, England M.J. Evans

HALLO, ELYSÉES 20-60

AIR FRANCE's NEW MANAGEMENT

Max Hymans, Chairman of Air France, at whose suggestion the reorganization of the top management was carried out.

Louis Lesieux, Air France's new Managing Director, former Director General of the Paris Airport Authority.

René Briend, Deputy Managing Director of the French Government-owned airline Air France, has retired after an unusually successful career in national and international air transport: 1930 Manager of Air Orient; after 1934 successively Secretary General, Commercial Director and Deputy Managing Director of Air France; 1944 French delegate to the Chicago Convention and co-founder of the new I.A.T.A. — His retirement has necessitated a reorganization of the Air France Management. New *Managing Director,* appointed on the recommendation of Air France Chairman Max Hymans, is *Louis Lesieux* (born 1907), who made his name during the planning and construction of the new airport at Orly, Paris and had been Director General of Paris Airport Authority since 1948. René Briend, who has been granted the title of Honorary Managing Director, will continue to serve Air France in an advisory capacity. — A film strip of the new Air France management:

René Briend, retiring Deputy Managing Director under whose management Air France built up the world's longest route network.

Maurice Lemoine (1903), Air France Secretary General, an international authority on air law (France's delegate to I.C.A.O. and I.A.T.A.'s Legal Committee).

Raymond Dupré (1906), who has advanced from Technical Director to one of two Assistant Managing Directors.

Robert Montarnal (1908), hitherto Commercial Director, becomes Assistant Managing Director, with Raymond Dupré.

Pierre Fromheim, hitherto Air France representative for West and Central Europe with headquarters in Frankfurt, becomes Operations Manager.

Pierre Cot who has been appointed to succeed Louis Lesieux as Director General of the Paris Airport Authority. Not to be confused with the former French minister of the same name.

• Reader Evans couldn't be clearer. INTERAVIA has known for some weeks that it was duped by a hoax perpetrated in Washington where, incidentally, the stunt raised considerable dust because newspapers and magazines all over the nation had fallen for it. — Ed.

Sir,

. . . I can only repeat my compliments to *Interavia* on its issue for March 1955 . . . In my humble opinion as exhaustive a study of a brand-new aircraft type such as you published on the *Skyhawk* is quite sensational. Even at the risk of seeing you accused of "espionage", you should be encouraged to continue along this path . . .

Montigny s/Sambre, Belgium — Roland Semal

• INTERAVIA's study, signed as it was by E. H. Heinemann, Chief Engineer of Douglas Aircraft's El Segundo Division, was obviously based on the most legitimate sources—in line with INTERAVIA's editorial policy. — Ed.

Sir,

. . . For the past ten years I have been a regular reader of *Interavia* and possess the entire collection of issues from the first one onwards. I must say I have never seen a magazine which deals with everything concerning world aviation in such a masterful manner, and I can only praise the accuracy of your facts.

I know that many readers would like to see more articles devoted to one or another subject in which they may be particularly interested, but I am sure you will continue to produce an ever more attractive and complete review. Will you ever be bold enough to write about Switzerland's aircraft industry?

Zurich, Switzerland. — Marcel Nussbaum, Engineering Undergraduate, Federal Institute of Technology

• Turn to page 442 of this issue. Also INTERAVIA for March, 1954. — Ed.

Navigation Meeting

Sir,

Your readers should be interested in the specialized professional and scientific information available at the forthcoming Annual Meeting of the Institute of Navigation. The 11th Annual Meeting of the Institute of Navigation will be held at the Air University, Maxwell Air Force Base, Montgomery, Alabama, on 23, 24 and 25 June 1955. Presentations will cover theoretical and practical aspects of civil and military navigation, ranging from items of interest to the small boat navigator through the problems of interplanetary navigation.

The President of the Institute of Navigation is now Major General Norris B. Harbold, United States Air Force Director of Personnel Procurement and Training. Past Presidents have included Mr. Ed Link, of Link Trainer fame, and Captain P.V.H. Weems, the father of the Weems System of Navigation and the Weems Plotter.

The Program will include a tour of the Air University. The City of Montgomery itself is of great interest because of its beauty and historical landmarks, such as the White House of the Confederacy.

Individuals or organizations interested in presenting papers of scientific or general interest or in presenting exhibits of equipment are invited to contact the Program Chairman for further details.

Arlington 7, Va. — Percy L. Jones, Major USAF, Program Chairman, Institute of Navigation

Book Reviews

Dictionnaire de l'Aviation Civile et Militaire. — By Paul Marchand. Blondel la Rougery, Paris 1954 (French-German and German-French).

A dictionary prepared in very clear and practical form, in which one or more translations of the word required can be found rapidly. In his preface, M. Maurice Roy, Director of O.N.E.R.A., describes it thus: "A bilingual dictionary of this kind aims merely at giving the equivalents for technical terms... M. Paul Marchand has obviously put all his efforts into this laborious work." With the aid of the 22,000 words covered here, the user (whether of French or German mother tongue) can solve practically all problems of aeronautical technical language. Di.

Deutsches Land in 111 Flugaufnahmen. — In "Die Blauen Bücher" collection, published by Karl Robert Langewiesche, Königstein im Taunus. (German, 112 pages, price DM 4.80).

If *Interavia* had not received this handsome picture book to review, the Editors would have bought it themselves—which would not have greatly overstrained their budget. The 111 cleverly chosen aerial photographs are eloquent evidence of the aerial camera's ability to photograph from new angles and provide new impressions of well-known cities and countrysides. Unlike so many books of its kind, this volume also includes a highly readable foreword deprecating the increasingly stereotyped nature of landscape photography. He.

Aerodynamik der reinen Unterschallströmung. — By F. Dubs. — Birkhäuser, Basle and Stuttgart, 1954 German, 225 pages, price Fr. 22/DM 22).

The author, former student of Professor J. Ackeret and now instructor at the engineering section of the Zurich Vocational School, gives a readily understandable summary of the most important principles of subsonic aerodynamics. His book is intended for a wide circle of readers, but differs from other popular scientific works in that it deals more thoroughly with its subject matter. — An introductory section on peculiarities of the atmosphere is followed by chapters on fluid laws, forms of flow, wind tunnels and airfoil theory, with frequent reference to recent research results. Considerable space is given to lift distribution and induced drag in swept wings, and to the influence of individual airfoil characteristics on lift and drag. The book is completed by a bibliography, name and subject index. Re.

Mécanique Vibratoire, by Robert Mazet Librairie Polytechnique Ch. Beranger. Paris, 1955 (French 280 pages, 160 figures).

M. Mazet, Scientific Director of the French *Office National d'Essais et de Recherches Aéronautiques* and professor at the *Ecole Nationale Supérieure d'Aéronautique,* reproduces in this book the courses he gave at the School from 1950 to 1954, supplemented by his experience at O.N.E.R.A.

The book, written for "advanced" engineers, opens with a synthesis of the dynamics of so-called linear mechanical systems, underlining the analogy shown by various phenomena in branches of science such as electricity, mechanics, acoustics etc., previously regarded as separate and distinct. There is, in fact, known to be a close analogy between electric vibrations and mechanical vibrations, which leads the author to a general theory of vibrations applicable to all mediums. Numerous examples and calculations are taken from aeronautics, which is directly concerned with these phenomena. Di.

Kleingasturbinen, insbesondere zum Fahrzeugantrieb. By Prof. Dr.-Ing. K. Leist. — Printed in manuscript form as No. 71 in the series of Research Reports issued by the North Rhine-Westphalia Ministry of Transport and Economics (editor Prof. Leo Brandt). — Westdeutscher Verlag, Cologne and Opladen, 1954 (German; 104 pages; price DM 22).

In this very thorough, well illustrated paper Professor K. Leist, head of Aachen Technical University's Turbine Institute, and his co-author Dipl.-Ing. K. Graf, discuss the general structural principles and qualities of small gas turbines of 100 to 300 h.p. effective power, with special reference to their use in road vehicles. Turbines examined are by Boeing and Solar Aircraft (United States), Rover, Centrax, Austin and Budworth (Britain), Turboméca, Socema and Laffly (France) and Centro de Estudios Técnicos de Automoción (Spain), as developed up to 1953. Special attention is given to power, economy, torque, braking power, weight, dimensions, installation, noise produced, life, etc. It is shown in particular that the useful torque plotted against rotary speed is considerably more favourable in turbine engines with driving turbine and compressor turbine than in piston engines, so that fewer gear stages are needed (e.g., two instead of four). Contrary to a widely held view, such turbine engines can also be used to brake the vehicle: when driving downhill the engine is put into reverse gear so that the vehicle's wheels drive the driving turbine (independent of the compressor turbine) backwards; a stream of gas, regulated by the throttle, then strikes the blades running in reverse and elastically brakes the vehicle. To improve economy, heat exchangers (Spanish C.E.T.A. turbine) and carbon dust brake chambers are proposed and discussed. — A very valuable report for all engineers. Ri.

Instrumentos de a bordo en aeronaves. — By V. Torres Sirerol and M. Hernandez Molina, lieutenants in the Engineers Corps of the Spanish Air Force. Editorial Aeronáutica, Madrid 1955 (Spanish, 583 pages, price 200 pesetas).

This comprehensive up-to-date book, which has been approved by the Spanish Air Force and included in the Airman's Library, describes the theory and functioning of aircraft instruments in clear, concise form with a profusion of diagrams and figures and, where necessary, the basic mathematical data. The book is divided into six chapters. The first deals with fundamental physical aspects, and the second with general considerations. The four others cover respectively engine, flight, navigation and auxiliary navigation instruments.

The book fills a definite gap in Spanish technical literature. It has been compiled most systematically, and no modern instrument is omitted: Zero Reader, Machmeter, VOR and DME equipment, accelerometers, remote-reading compass, automatic pilot, as well as the various systems of autosyn, dessyn, magnesyn etc. transmission.

It thus deserves wide circulation in aeronautical circles throughout the Spanish-speaking world, where it will without doubt be welcome both for its new matter and for its fine presentation. Sa.

Books received

"*Strömungstechnik*", *special reprint* not commercially available (135 pages) from Landolt-Börnstein "Zahlenwerte und Funktionen aus Physik, Chemie Astronomie, Geophysik und Technik; 6. Auflage". The extract covers pages 662 to 796 of the first section (materia values and mechanical behaviour of non-metallic materials) of Volume IV (Engineering) and deals with flow through tubes and flow round bodies. Volume IV/1 has been edited by Prof. Ernst Schmidt and 22 colleagues. — Springer-Verlag, Berlin-Göttingen-Heidelberg, 1955. (German; XVI, 881 pages; 1,104 illustrations; price of Volume IV/1 DM 288).

*

Publications scientifiques et techniques du Ministère de l'Air.

Distributed by the Service de documentation et d'information technique de l'Aéronautique, Paris

Nr. 296: *Journées de mécanique des fluides* — Colloque du Centre nationale de la recherche scientifique (Marseilles, January 1952).

No. 297: *Chaleurs spécifiques et entropies des hydrocarbures et de quelques combustibles liquides,* by M. Aubert and N. Sibolev.

No. N.T. 50: *Méthodes de différentiation et d'intégration numériques (Applications),* by A. Ziller.

No. N.T. 51: *Tuyères supersoniques à col réglable,* by M. Ménard and O. Monod.

*

I.C.A.O. (English, French, Spanish):

Doc. 7181—COM/546/3: contains all annexes accepted by the I.C.A.O. Council up to February 1st, 1955 and replaces earlier editions from October 1st, 1955.

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The *VORTAC* Air Navigation System Controversy

Forthcoming Decisions Will Affect Civil and Military Flying Throughout the World

BY MAURICE A. GARBELL, D. SC.
PRESIDENT, MAURICE A. GARBELL, INC., AERONAUTICAL ENGINEERS AND CONSULTANTS,
AND GARBELL RESEARCH FOUNDATION, SAN FRANCISCO

An intense controversy, perhaps without precedent in any highly technical field, has emerged partly into the open in the United States. Civil and military agencies have been differing widely over the possible adoption of a new common system of air navigation and air traffic control. The ramifications of this problem in every field of flying are far-reaching and important. Its resolution will have a profound effect on future aeronautical planning in the United States and, by possible modification of existing ICAO agreements, on civil and military aviation throughout the world.

The public, through spirited news reports, has been given only glimpses to date of the vexations that have been brewing within coordinating technical agencies of the United States Government and between Government and Industry, and of the reverberations of the controversy in virtually every congressional committee in Washington, D. C., that has any jurisdiction over military or commercial matters. Yet, even though the dispute is far from settled and some participants remain shrouded in the mystery of military secrecy, it is still consistent to review the object of the controversy in the light of its true nature, namely that of a technological and operational dilemma in a field in which developments frequently move so rapidly that equipment—and at times even the entire framework of human thinking and planning—become obsolete almost before it has reached the hands of the user.

The dispute, briefly referred to as the " VORTAC Controversy ", goes back to the immediate post-war period (1946-1947), when the need for an improved electronic air navigation system in the United States became manifest. Up to that time, continental air navigation had been primarily conducted by flying along one of *four* clearly identified " on-course " lines established by a *low-frequency range station*. An aircraft could not obtain safely usable guidance at any point away from the four " on-course " lines, neither could a pilot be certain of his distance from the transmitting station except when flying directly over one of the few auxiliary radio beacons or fan markers placed on the " on-course " lines or over the range transmitter itself.

In 1947, the United States Congress recognized the necessity for an improved system of air navigation and also the imperative need for unification or at least full compatibility of all military and civil developments in air navigation and air traffic control.

The Executive Branch of the Government, through its policy-making Air Coordinating Committee (Departments of State, Army, Navy, Air Force, Treasury, Post Office, Commerce, Civil Aeronautics Board) requested the Radio Technical Committee for Aeronautics (RTCA) to propose a solution to the problem of a " Common System " of air navigation and air traffic control.

The RTCA, a relatively informally-constituted, technical government-industry group, recommended a pattern of development including interim and ultimate solutions, to which all participating interests agreed.

Following approval by the Air Coordinating Committee and the Congress, work began in 1948 on the implementation of the Common System ; the actual technical development was to be directed and administered by the newly constituted Air Navigation Development Board (ANDB - Departments of Defense, Army, Navy, Air Force, and Commerce).

The backbone of the new interim air navigation system was a network of " VOR's ", or very-high-frequency omni-directional radio ranges, operating in the 112-118 mc frequency band. A pilot could read his course line to and from the VOR station at any point of a line-of-sight horizon ; he could fly along any desired VOR radial with the aid of his ILS localizer needle. His orientation was no longer limited to four " on-course " lines.

A second necessary element of information was to be supplied by the " DME " or distance-measuring equipment, a pulse-type device operating in the 1000-mc region, and usually co-located with a VOR or an ILS, which provided the pilot with a continuous reading of his distance from the omni-range or other DME reference point.

The VOR laid out a radial line between itself and the aircraft ; the DME stepped off a distance along that radius. The two together established the position of the aircraft at all times with satisfactory accuracy and kept the pilot so informed by means of dial, counter-type, and ILS-localizer-type indicators mounted on his instrument board.

The common air navigation system also comprised a number of radar elements, such as radar transponder beacons intended for the identification of aircraft on the ground radar scopes. These radar elements, incidentally, are not objects of the current controversy and are in advanced stages of joint civil-military development.

Following approval of the new air navigation system, the Civil Aeronautics Administration (CAA) of the U.S. Department of Commerce obtained from Congress the necessary budgetary funds and installed approximately 460 VOR's (80 percent of its goal for 1960) and approximately 447 DME's (60 percent of its goal for 1960). Likewise, military aircraft, airliners, and other commercial, executive, and personal aircraft have been widely equipped with VOR and, to a somewhat smaller degree, with DME indicating instruments ; scheduled airlines have shown little interest in DME. The U. S. Government had endorsed the adoption of the VOR system by ICAO for international use, with the understanding that all distance-indicating equipment be of the American DME type. A multi-million dollar investment was made by governments as well as by owners of aircraft.

Meanwhile, beginning in 1947, the U.S. Department of the Navy undertook the development of a purely tactical aerial navigation system (TACAN), capable of both azimuth and distance indication in a single unit, and affording maximum security against jamming or navigational use by enemy aircraft and against overload failure through excessive interrogation, and suitable for installation on aircraft carriers. In 1950 the U. S. Air Force joined the development of TACAN as a participant and co-sponsor. The military work on TACAN was covered by security restrictions during the intervening years, thereby precluding any free exchange of information between the agencies developing VOR/DME and TACAN, respectively.

Conceivably, it was at this stage that the present controversy could have been resolved amicably and at a small cost. In the opinion of some observers it is puzzling why an *exchange of information between the military and civil agencies of the U. S. Government could have been so difficult to establish* when Air Force-Navy-CAA collaboration had been so close in other complicated problems in air navigation and air traffic control, such as, for example, the Berlin Airlift.

The initial TACAN development, as a purely tactical system for use aboard aircraft carriers and in far-off combat areas, did not appear inconsistent with the VOR/DME system then accepted as the overall civil-military Common System for the air traffic lanes of the United States and the world. However, the entry of the U. S. Air Force into the TACAN development expanded the scope of TACAN to cover the continental air defense responsibilities of the Air Force, and led to the emergence of plans for TACAN as a national United States system of air navigation and air traffic control.

With the advance of TACAN to the position potentially of a continental air navigation system, its need for use of the full 255-mc-wide band of frequencies available in the 1000-mc region brought it into direct conflict with the civil DME system which operates in a 50-mc-wide band in the same frequency region.

About two years ago, the differences were at a point where arbitration of the military and CAA programs might possibly have done the most good. Unfortunately, however, the logical tribunal for such an issue, namely, the Air Navigation Development Board (ANDB), appeared in a state of impotence attributable to the withdrawal of the military during the Korean conflict. As a consequence, lacking agreement and interchange, the CAA and the military services each continued their respective procurements and developments at an accelerated rate.

When, in 1954, the ANDB reappeared as a duly empowered civil-military coordinating and working agency, with a new membership and a new staff, it established almost immediately a 7-man "VORTAC" committee to resolve the controversy in the best national interest. The committee retained Messrs. R. C. Newhouse (Bell Telephone Laboratories), H. R. Skifter (Airborne Instrument Laboratory), and J. B. Wiener (Electronics Research Laboratory of the Massachusetts Institute of Technology), recognized experts who were not employed by firms directly interested in the outcome of the dispute, to analyze and weigh the strictly technical aspects of the two controversial air navigation systems.

The VORTAC committee issued a report on February 8, 1955, in which it unanimously accepted and endorsed the following essential findings of its technical consultants:

Technical Findings of VORTAC Consultants

Siting	VOR requires siting in flat terrain without any obstructions within 1000 feet. TACAN siting is less critical; also, imperfections in siting of TACAN can be overcome merely by raising its antenna (without making it a navigational obstruction).
Accuracy	
Azimuth	VOR with good siting: within 3°, adequate for civil needs but reportedly not satisfactory for tactical military requirements. TACAN reportedly better than 1°.
Distance	DME and TACAN both meet civil and military requirements.
Reliability	VOR operationally tested and found highly reliable. DME found reliable in limited operational experience. TACAN found unreliable in its present form and requiring re-engineering of both ground and airborne equipment to meet civil aeronautics standards.
Size, Weight, and Cost	
Ground Equipment	Complete TACAN vs. VOR/DME: No significant difference except for a large counterpoise required by VOR.
Airborne Equipment	Complete TACAN vs. VOR/DME: No significant difference.* TACAN azimuth element vs. VOR: Significantly in favor of VOR; TACAN distance element vs. DME: Significantly in favor of DME.
Ground-to-Air Communications	TACAN does not provide either station identification or communication by voice; VOR does. Voice identification can be added to TACAN; two-way voice communication cannot.
Compatibility	TACAN and DME cannot coexist because of unavoidable mutual interference of band frequencies. TACAN and VOR are not incompatible, but if they are located within 1000 feet of one another (as is required for efficient air traffic control), VOR accuracy may suffer; co-axial installation reportedly injects additional structural difficulties. The problem of interference with other services in the 960-1215 mc band should be carefully studied and resolved.

* E.g., the AN/ARN-21 airborne TACAN equipment weighs only 85 lbs., including aerial, indicators and cables. - Ed. -

While the VORTAC committee unanimously recognized the validity of these and presumably other (still classified) technical findings, the committee members disagreed sharply on the ultimate choice between TACAN and VOR/DME.

In an attempt to resolve a seemingly hopeless impasse, the committee considered several possible alternate systems, such as, for example, combinations of pulsed or continuous-wave azimuth with the existing DME. The three technical consultants discouraged all of the alternatives, because the time and cost of needed additional development on such alternate systems appeared out of proportion to the slim possibility of the resulting systems meeting military requirements.

At last the VORTAC committee voted 4 : 3 in favor of TACAN and passed its recommendation on to the Air Navigation Development Board.

The Air Navigation Development Board received the 4 : 3 recommendation of its VORTAC committee in February, 1955, and approved the following program in which, incidentally, the Department of Commerce representative, Transportation Undersecretary, Robert B. Murray, Jr., concurred "reluctantly", despite the opposition voiced by the Civil Aeronautics Administration:

ANDB Program

VOR	Continue VOR as the Common System short-range navigation aid until 1965; this is actually two years longer than was originally planned in 1948 by RTCA, when a termination date of 1963 was set.
DME	No guarantee of DME service other than experimental after June 30, 1955, thus making DME frequency band available to TACAN when ready and needed.
TACAN	Complete TACAN development to improve its reliability and make it suitable as a Common System for short-range air navigation by 1965. Authorize military use of TACAN for minimum military interim requirements on channels that do not interfere with authorized DME channels and the Common System radar transponder beacon frequencies. (Installation of an initial military TACAN airway system, with 170 ground stations tracing four meridional and three latitudinal airways was foreshadowed more recently for 1957.)
UHF Omni-Range	As a "fall-back" system to guard against the possible inadequacy of future TACAN development, develop a continuous-wave Ultra-High-Frequency (UHF) Omnirange in the 1365-1600-mc band to replace VOR ultimately for all military and civil needs in combination with present civil DME.

In substance, the significant reasonings of the various members of the VORTAC committee may perhaps best be expressed in the following summary:

POSITIONS TAKEN BY VORTAC COMMITTEE MEMBERS

In Favor of TACAN over VOR/DME

Air Force, Army, and Navy

TACAN is a *single-unit system*; this is imperative for relatively small and highly loaded, complex military aircraft; VOR and DME are two separate systems.

TACAN provides a maximum of *security* against jamming and navigational use by an enemy.
The *accuracy* of the TACAN azimuth element is less sensitive to defects in siting and presence of low-level obstacles nearby (for example, ships in a naval convoy near TACAN-equipped aircraft carrier).

DME can achieve a desired 100-channel *capacity* only by multiplexing, for example, by superimposing 10 pulse modes on 10 interrogation and 10 reply frequency channels.

TACAN is believed to achieve the same capacity by employing 100 narrower, *clear* channels over a wider band in the same frequency region. TACAN might conceivably be less subject to spurious overloads due to unwanted interrogations.

There is no need to "do away" with DME stations; CAA can convert them to TACAN at a reasonable cost.

TACAN'S remaining engineering difficulties and "bugs" are no worse than those which confronted VOR a few years ago; they are now being readily resolved.

Air Transport Association

Considers (1) DME as a "luxury" for present airline needs;
(2) VOR/DME as "fully adequate to meet present airline needs";
(3) VOR as "not adequate for military use".

Reasons that, if a "Common System" of air navigation and air traffic control is to be achieved for all civil and military needs, partial non-interfering assignments of frequency bands in the 1000-mc region to DME and TACAN, respectively, would be unthinkable and, if the VOR/DME will not satisfy military requirements, "we would have no choice but to accept the economic and operational burden imposed by the transition to TACAN in the interest of continuing a common system for civil and military users."

Opposed to TACAN over VOR/DME

Aircraft Owners and Pilots Association
National Business Aircraft Association, and
Civil Aeronautics Administration

Fear that adoption of TACAN will doom not only DME but VOR as well, since VOR equipment plus TACAN distance equipment would be heavier and costlier than present VOR/DME combination. Hence, private pilots would face immediate obsolescence of VOR and need to re-equip themselves with complete TACAN.

Assert that in the interim while TACAN is still under development while DME is no longer an operating system, business pilots will suffer because they will no longer have distance indication which is essential to them in off-airway flying and let-downs and in approaches to ILS/DME equipped airports away from VOR stations.

Similarly, if TACAN is not yet ready while DME is already abolished, distance indication, which may be essential in airline jet operation, will not be available.

Contend that " it seems untenable that an existing system can be replaced by an unproven and experimental system " and that TACAN " still is highly speculative."

The Air Navigation Development Board is still beset with the clarification of several uncertainties, including the complete declassification of TACAN and the determination of the availability of interference-free channels for TACAN in the presence of the heavy demands for channels for the national air defense network ; another problem that follows is the necessary introduction of a State Department recommendation to ICAO to establish an international TACAN network in lieu of the VOR/DME network currently recognized as an international standard. The physical tasks involved in such change would be relatively small, since only a limited number of VOR stations, and an even smaller number of DME transmitters, has been set up, mostly in Europe. It may also be anticipated that in order to compensate for any hardship to private owners of DME receivers, some form of adjustment or replacement with TACAN receivers is planned.

So far as the military establishments of the other NATO countries are concerned, there is every reason to believe that their needs—and hence their viewpoint—should be similar to those expressed by the U.S. Air Force and Navy.

The ANDB decision, meanwhile, is far from having pacified the controversy. The Civil Aeronautics Board and the State Department have reportedly expressed objections against the ANDB decision, and, after hearings by the Navigation Panel of the Air Coordinating Committee, and by a joint House-Senate Group of the Congress, the dispute may eventually be submitted to the White House. But the present spirited debate continuing in congressional committees and elsewhere should be viewed in its current perspective, namely, as an investigation only into the reasons for the temporary breakdown of the " common system " concept of air navigation aids.

*

Any political dissensions should not obscure the undeniable technical fact, namely, that a necessary, and hence unavoidable, step forward is being accomplished, albeit laboriously and cumbersomely, through an inescapable adjustment to life-and-death changes in military technology and global defense strategy which have become a reality since 1948.

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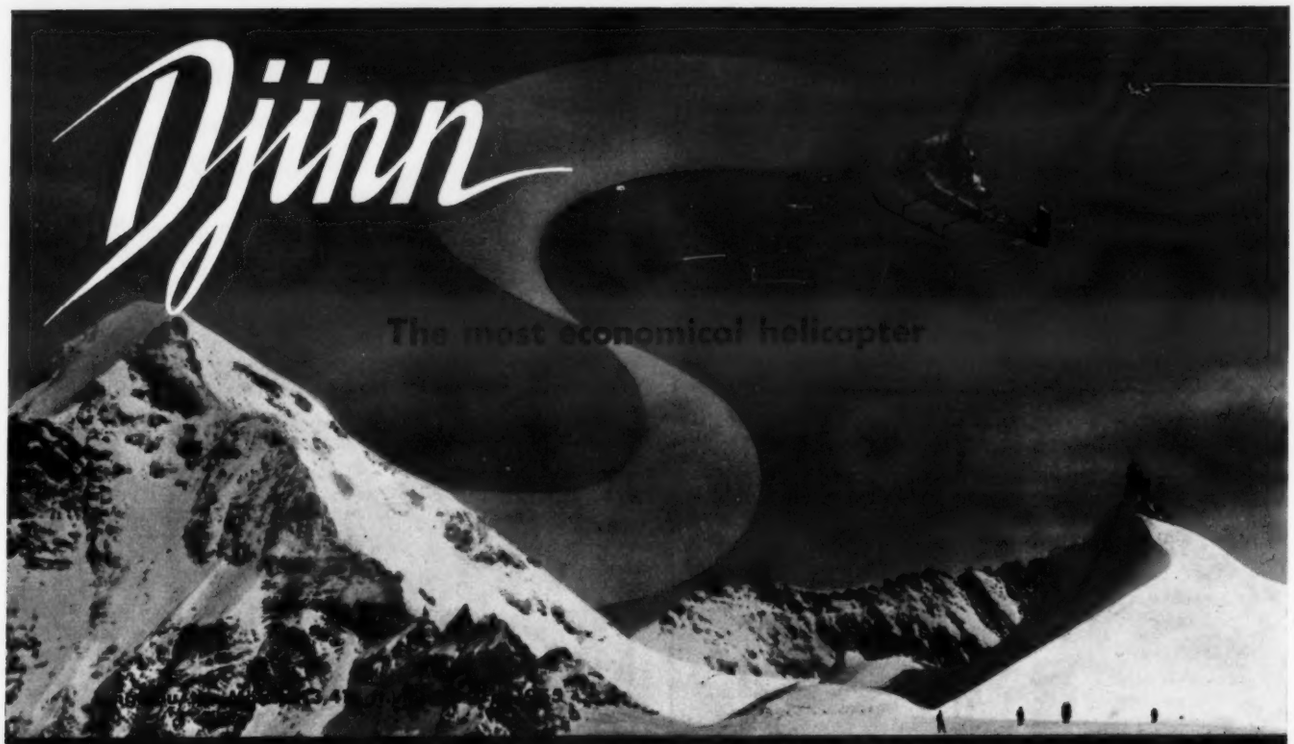

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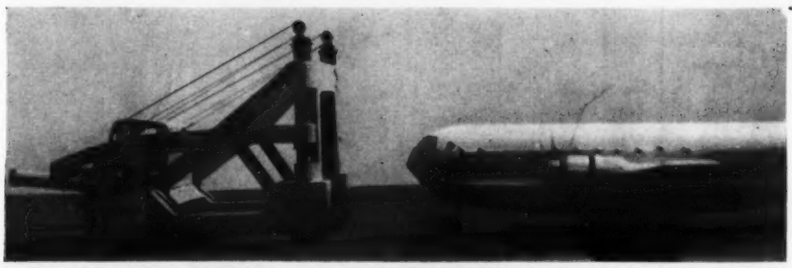

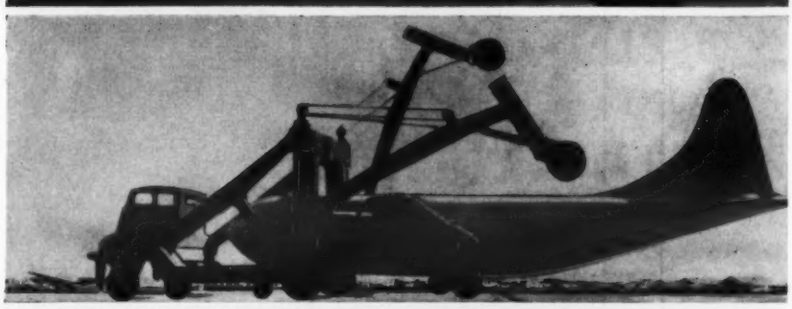

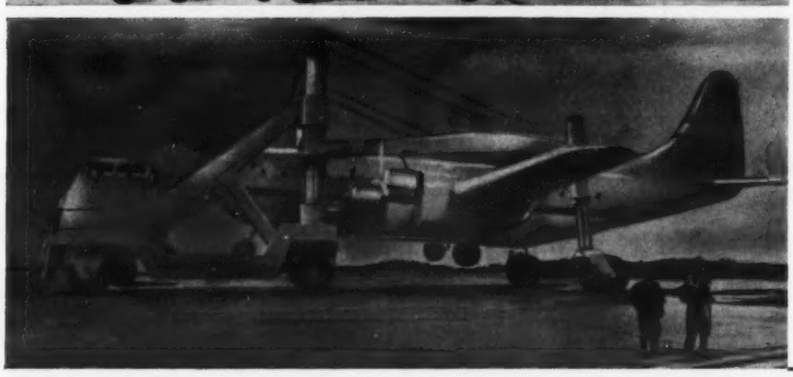

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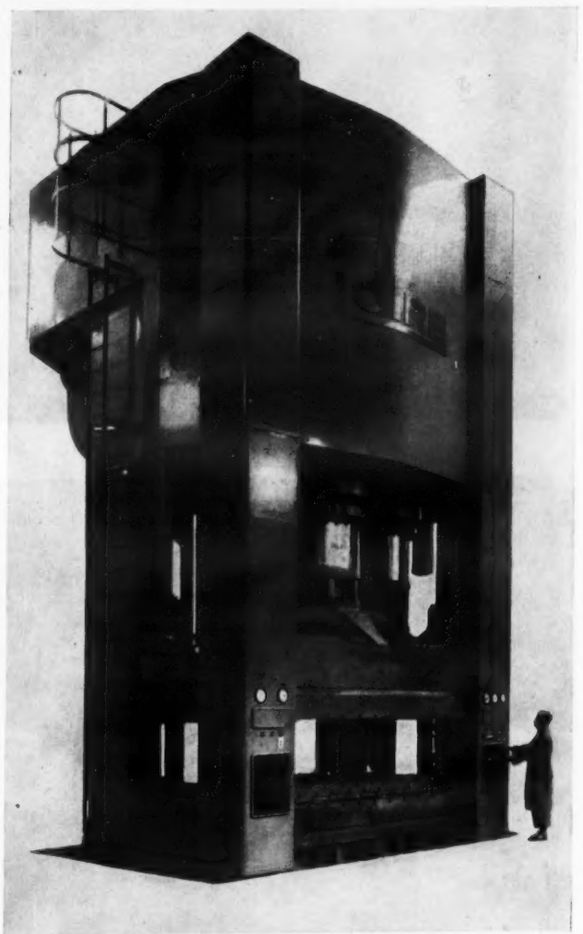

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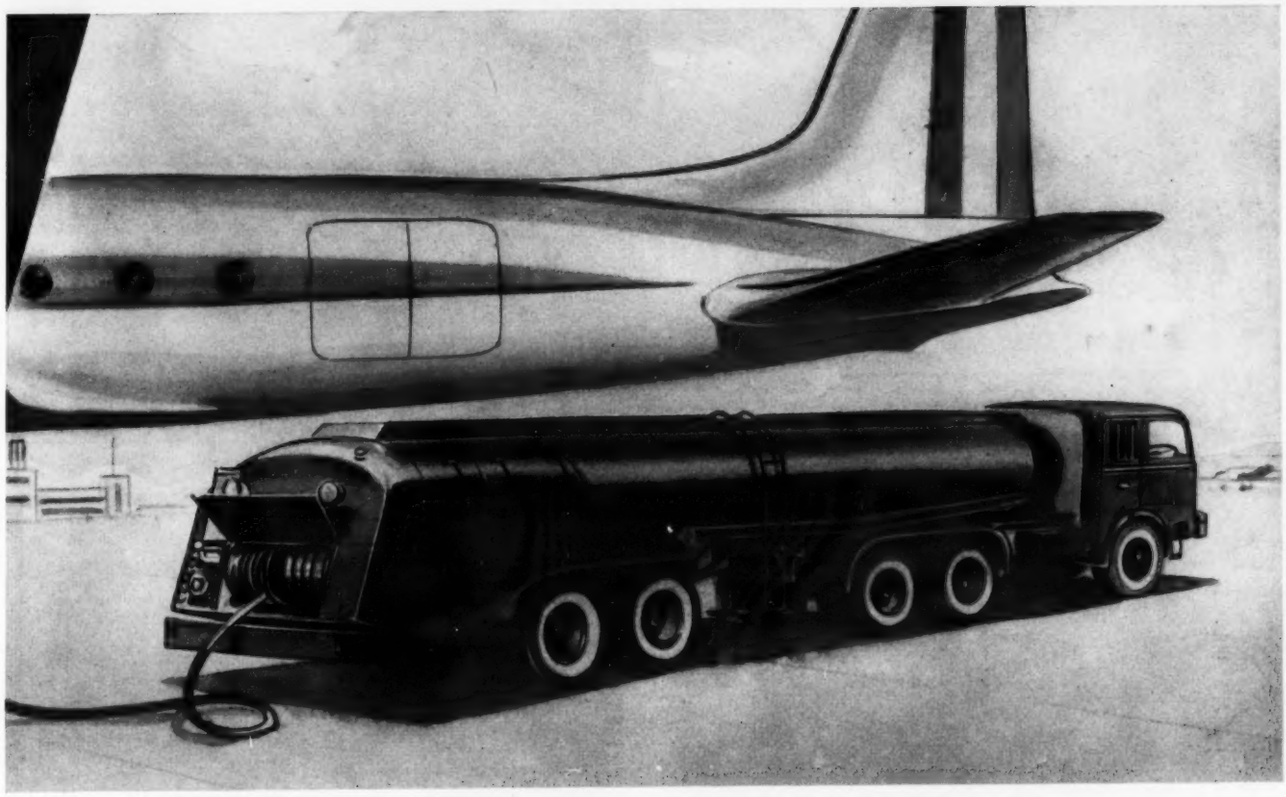

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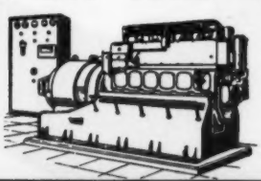

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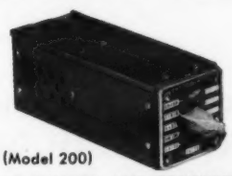

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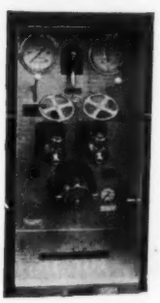

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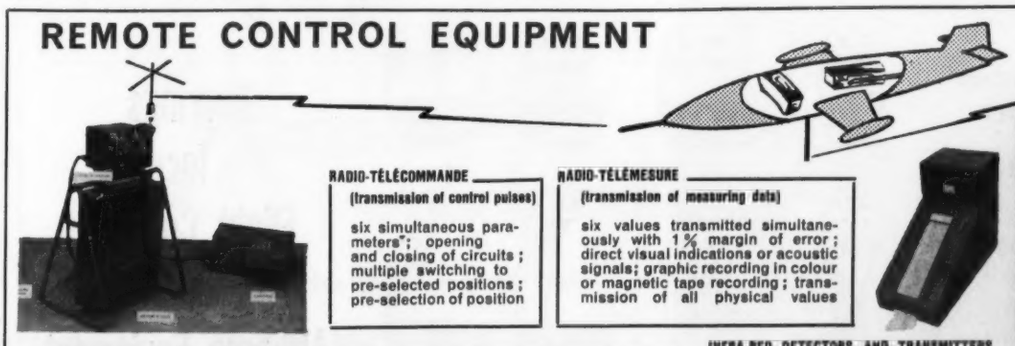

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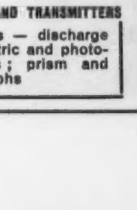

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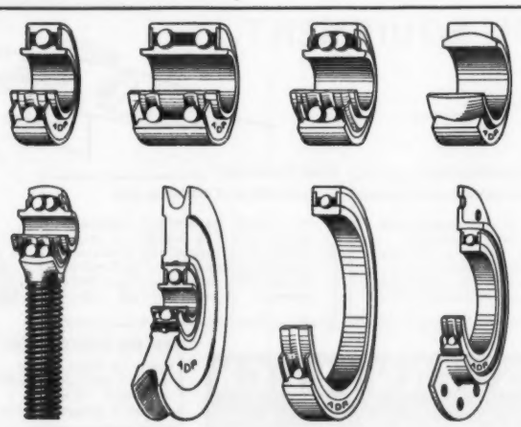

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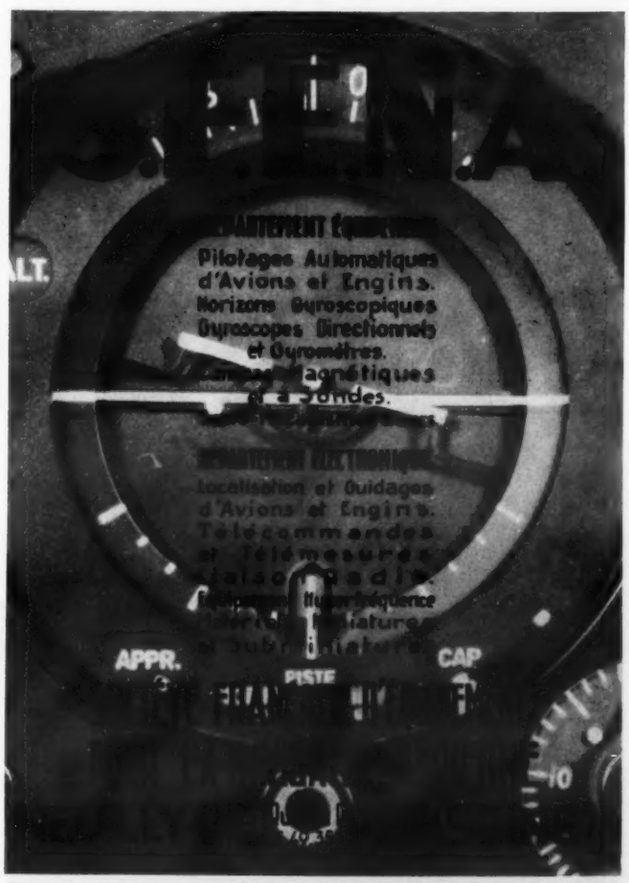

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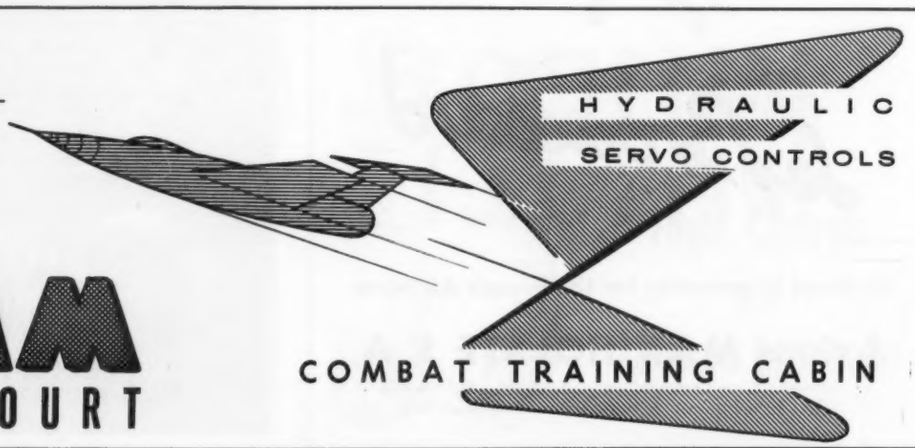

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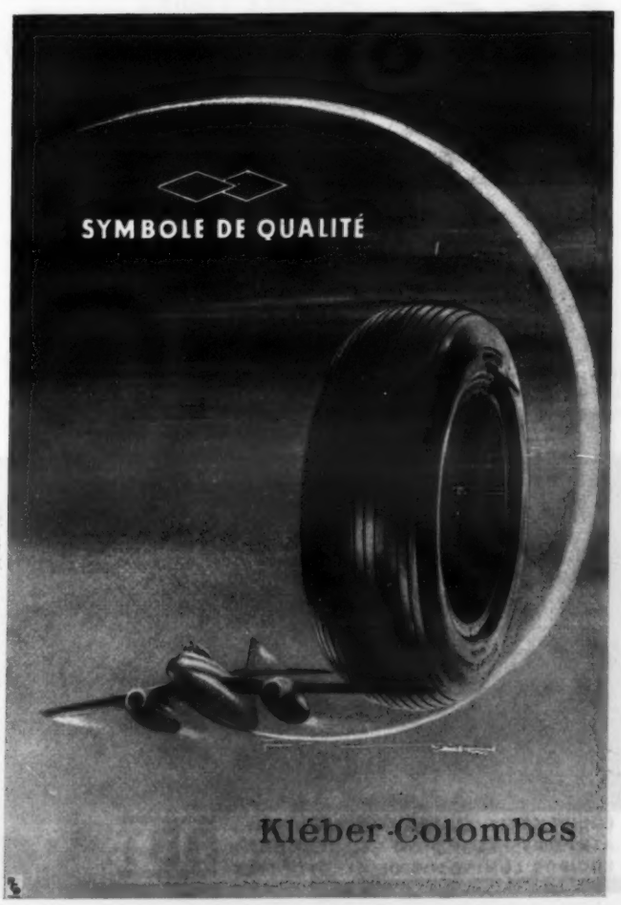

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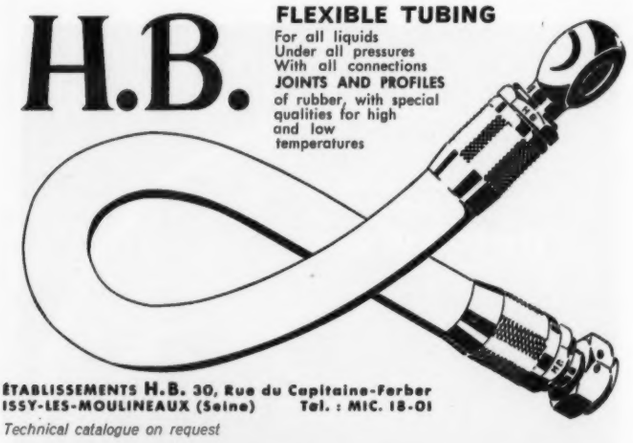

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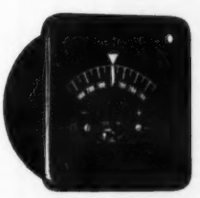

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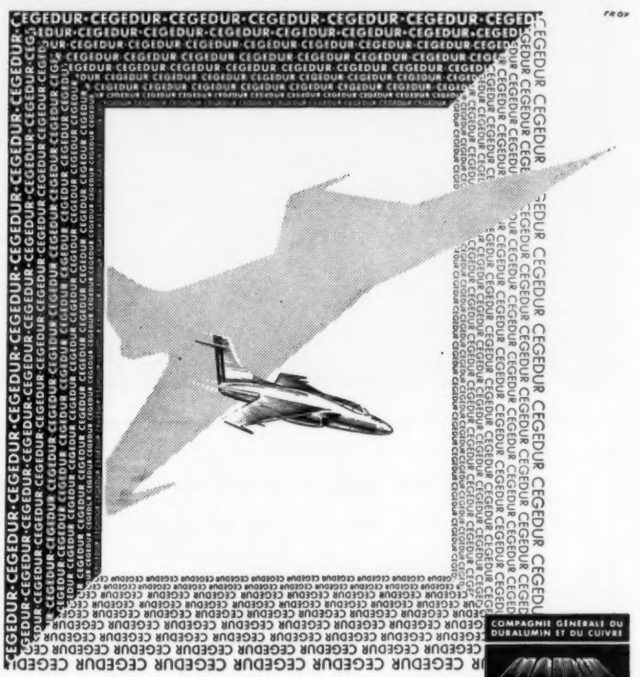

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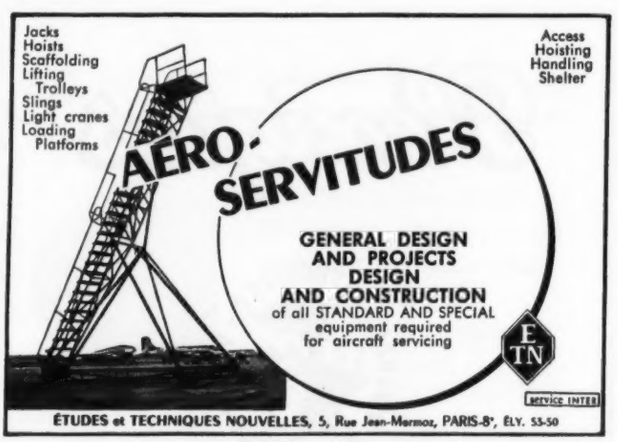

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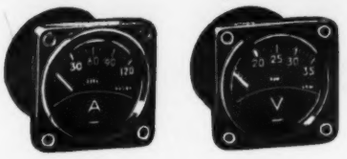

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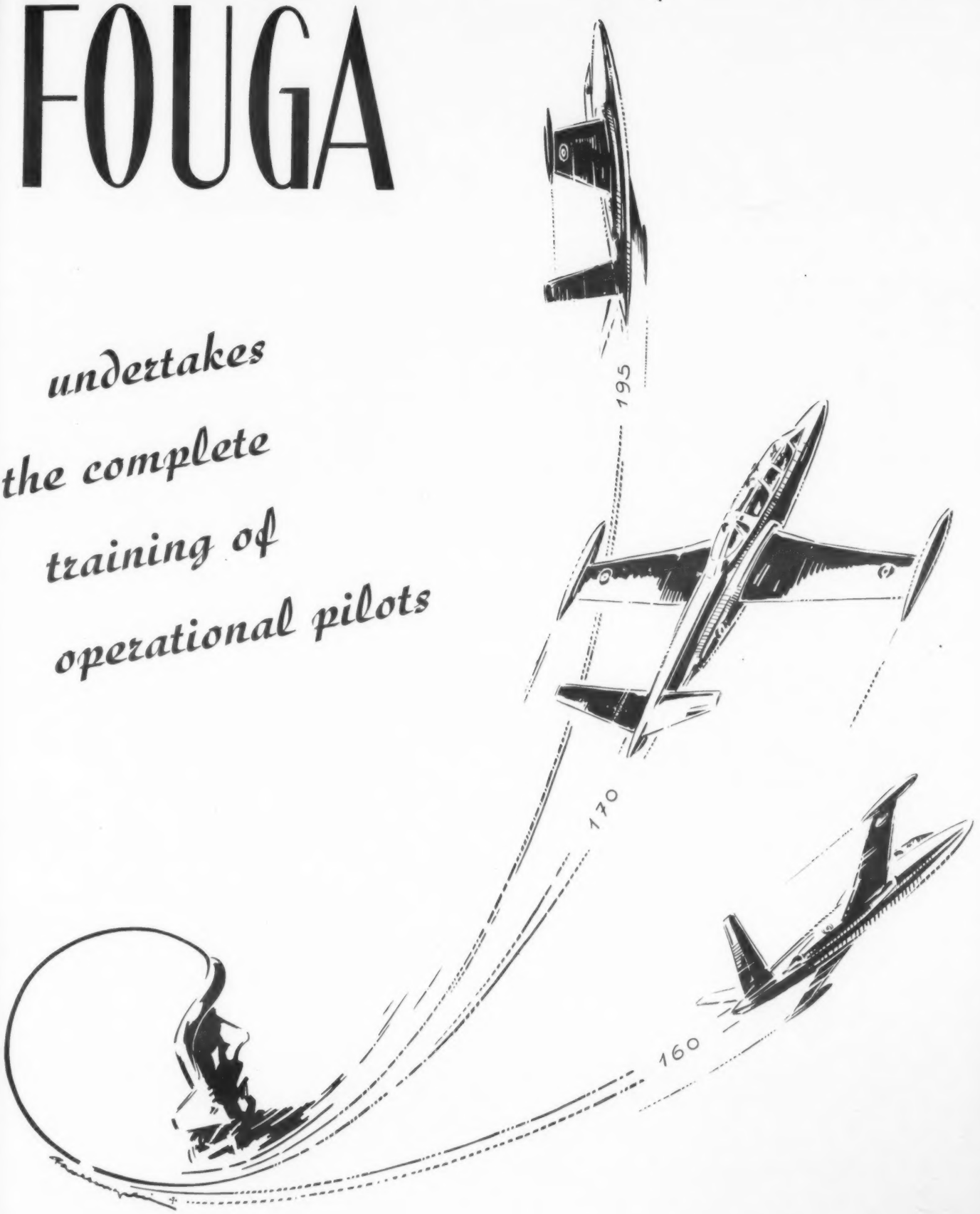

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